Volume 63

American Machinist

Number 23

New York, December 3, 1925

# Advantages and Disadvantages of Multiple Tapping

By W. F. Sandmann

ALTHOUGH practically all progressive manufacturers have installed multiple drilling equipment for production drilling, those who have adopted multiple tapping as standard practice are still in the minority. The principal objections to multiple tapping, if there ever were any real ones, have seemingly been overcome and the only obstacle retarding it now is the customary manufacturing prejudice, and this is rapidly disappearing also.

Multiple tapping offers two outstanding advantages — increased production and reduction of tap breakage. The fact that ten or twenty holes can be tapped in the same approximate time that one hole was tapped, easily demonstrates the advantage of increased production. It is a proved fact that upwards of 50,000 holes have been tapped on one multiple tapping machine, time after time, without breaking a single tap. This is easily accounted for. If an operator is tapping holes in a heavy piece of work on a single-spindle tapper and he fails to get the drilled holes in line with the tap, the chances are that the tap will snap in the effort of aligning the hole with the tapping spindle. When multiple tapping, if it should happen that the holes to be tapped are not squarely under the taps, the combined pulling power of the ten or twenty taps will quickly align the piece for the operation.

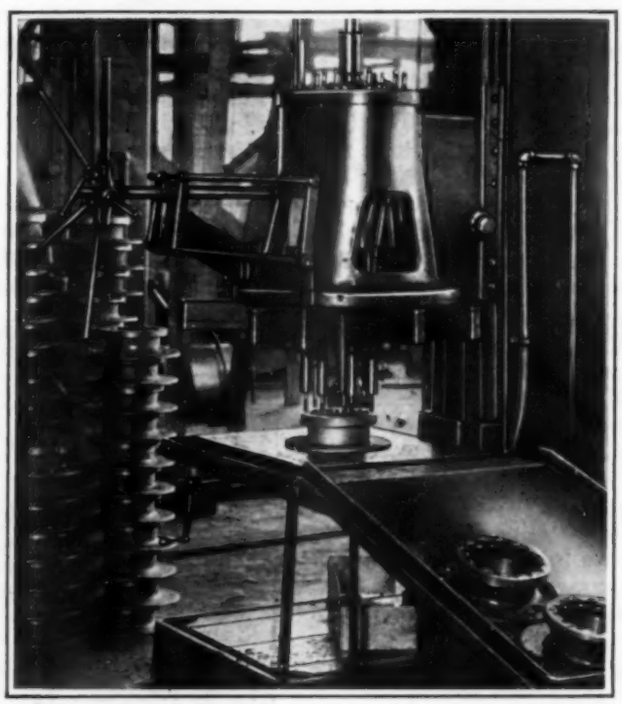


*Fig. 1—Multiple-tapping flanges for truck hubs*

On the other hand, there are some serious disadvantages in multiple tapping. The principal one, is one that the tapping-machine manufacturer is powerless to overcome, but luckily it affects only a few of the production plants. This disadvantage is the difficulty of securing sets of taps that are uniform.

This situation has in fact been so serious at times that several builders of high-grade automobile motors have turned away from multiple tapping because of their inability to secure sets of taps that are exactly alike. Their products demand very accurately tapped holes, so as to preclude the possibility of loose studs and screws, and to make the assembling and replacement of parts a simple procedure. It has been found by close inspection, that only between twenty and thirty taps out of a hundred will be exact duplicates. Therefore, if a crankcase contains fifty holes to be tapped, upward of two hundred taps will have to be purchased to obtain a duplicate set of fifty. Tap manufacturers are grinding their taps more accurately of late and are offering duplicate sets, but the cost is necessarily higher than the average. So the motor builders referred to, find they are getting better results at present by tapping their holes one at a time, and using the same tap for all the holes of the same size in a piece. Uniformity is thus assured.

Another objection to multiple tapping that is also out of the range of the tapping machine manufacturers, is the securing of suitable tapholders. Countless numbers of tapholders have been placed on the market, including friction types, floating types, positive-drive types, etc. Some have proved satisfactory and others have not. Some tapholders that have proved highly satisfactory in single-spindle tapping machines, are of no value in a multiple-spindle machine. A large number of production men have their own pet designs of tapholders, and blame the tapping machine if results are unsatisfactory.

In the design of a tapholder, there are several very important points that must be considered. The principal one, is the ease of putting a tap in the holder and removing it. Valuable time is lost on a job if this cannot readily be accomplished. The tap must not be gripped too tightly, but must have "float." Sometimes there is a slight variance in center distances of the holes to be tapped and there must be sufficient play to allow the tap to follow the hole. Provision must be made in the holder for vertical "float." When tapping many holes at a time it is not logical to suppose that every tap will "take hold" at exactly the same instant, so the vertical float is necessary to compensate for this. Also, many times holes that have slightly different leads are tapped at the same time. The vertical float in the holder will allow for this condition, since the tap with the coarser lead will feed down more rapidly. Tapholders should be designed so that different makes of taps can be accommodated, because purchasing departments cannot always secure the same type of tap, and the shanks of several different representative makes of taps vary considerably.

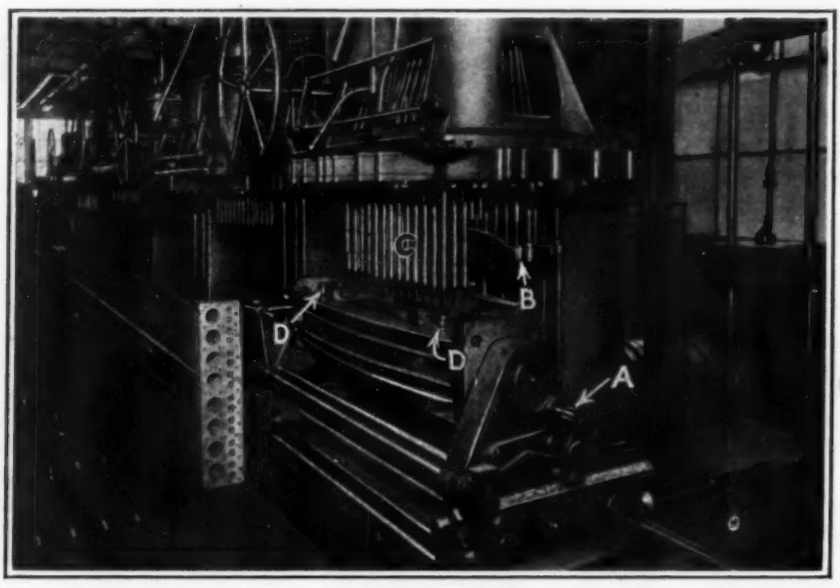



*Fig. 2—Multiple drilling and tapping machines in the Hupmobile plant*

A tapping machine in operation in the plant of the Timken Axle Co., tapping seven ⅝-in. 11-thread holes in a truck-hub flange, is shown in Fig. 1. No fixtures are required, nor is it necessary to guide the taps. The taps in this case are held in an adapter collet in the end of the spindle itself. Since the taps are fairly large, they are strong enough to pull themselves in without the aid of the floating-type holder.

A line-up of Natco multiple drillers and tappers in the Hupmobile plant, is shown in Fig. 2. This arrangement is what is known as a fixture-track set-up and makes very high production possible. This line-up is used for drilling, tapping and reaming all holes in the cylinder block of the Hupmobile eight-cylinder motor. The cylinder block is locked in the cradle of the rolling fixture and as the fixture passes along the track under the heads of the various machines, the operations are performed. The fixture is designed to index to four positions by means of the index pin *A*, so that all four sides can be turned to the machines. The first operation under the machine in the foreground is that of tap-drilling twenty-six holes in the top of the block, for the head capscrews. Drilling is performed at the rear of the machine at *B*. It will be noted that the fixture is on a sub-track that permits it to be rolled from front to rear under the head. When the drilling operation has been completed, the fixture is rolled to the front of the head at *C*, and the tapping is done. This type of machine is arranged with different speeds for each spindle, so that the drills and taps can each run approximately at their proper speed. The bushing plate carrying the drill bushings for the first operation, is fastened to the head of the machine and locates on the fixture over the pins *D*. When the tapping operation is performed, the fixture is therefore open, since no guides are used for the taps. When both operations have been completed on the first machine, the fixture is moved down the track and the various other machines perform their operations. When the last machine in the line-up has finished its task, the block is finished.

Another track arrangement, in the plant of the Canadian Overland Co., is shown in Fig. 3. No drilling is done on the two tappers, since the crankcases come to machines already drilled. On the first machine, the cylinder-head bolt holes are tapped. It will be noted that a friction-type tapholder is used, since the center distances between the holes is great enough to allow room enough for chucks of large diameter. The fixture is indexed 180 deg. and moved under the second machine. It will be seen at *A* that a sub sliding base is supplied so that the fixture can be moved back and forth under the machine head. At the rear position under the machine head, the pan holes are tapped and at the front of the head the bearing-cap holes for the crankshaft are tapped. When the crankcase is removed from the fixture, all holes in top and bottom have been tapped.

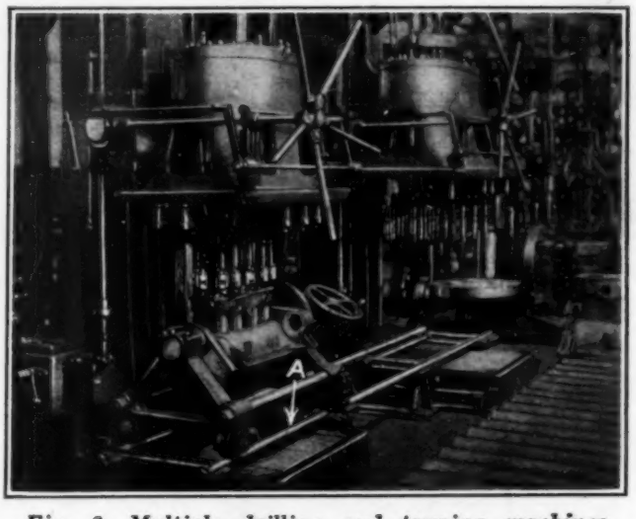



*Fig. 3—Multiple drilling and tapping machines served by a track*

The question is often raised as to how fast taps

should be run in multiple tapping. Taps can be run at the same speed they would be if but a single hole was being tapped. In multiple tapping, the taps are merely started in the hole by the operator lowering the head of the machine, and are then allowed to pull themselves down into the holes. It will often be found of assistance when soft metal is being tapped, if the operator will follow the taps down with a gentle pressure on the downfeed handwheel. This will give cleaner threads and lessen the tendency for the taps to tear.

There is really no valid reason why at least ninety-five per cent of the production plants should not be doing all of their tapping by the multiple method. Some production men maintain that to get perfect threads, the feed for the taps should be by a lead screw. They overlook the fact that a number of taps entering a piece at the same time will pull the well-balanced head of the machine down smoothly enough to make the lead screw unnecessary. However, tapping machine manufacturers will provide a lead screw when demanded.

It took multiple drilling, obvious necessity that it now is, some time to make any headway. Multiple tapping will come into its own much more rapidly. The experimenting was completed long ago. It is now up to the users to make the most of what is being offered them.

# Recent Decisions of the United States Board of Tax Appeals on Depreciation of Tools and Equipment

By Leslie Childs

IN THE case of the Pierce-Arrow Motor Car Co., decided by the United States Board of Tax Appeals on September 7, 1925, the question of the reasonableness of the taxpayer's deductions from its tax returns for the years of 1917 and 1918 for the depreciation of special tools and patterns came up for decision.

The findings of fact showed that prior to January 1, 1917, the taxpayer acquired special tools and patterns to be used in the production of automobiles for which it paid $950,528.32 in cash. In 1917 the taxpayer acquired further special tools and patterns of the value of $397,838.97, and during 1918 it purchased similar equipment for $494,243.44. The entire cost of such purchases was, it appears, capitalized.

The tools and patterns were of three classes: class A, those having a life of one year; class B, those having a life of two years and class C, those having a life of more than two years. Of the original investment 40 per cent were in classes A and B, and 60 per cent were in class C. Of the subsequent purchases made during 1917 and 1918, 63.7 per cent were of class A; 12.6 per cent of class B, and class C included 22.7 per cent.

### The Facts and the Decision

The taxpayer in the original income and profits tax returns for 1917 and 1918 deducted $176,940.76 for 1917, and $849,462.72 for 1918, against the cost of special tools and patterns. Thereafter the 1918 deduction was objected to by a revenue agent, and the taxpayer on June 7, 1922, filed an amended return for the years 1917 and 1918, in which it claimed deductions for depreciation of tools and patterns of $489,438.74 for 1917, and $776,708.07, which sum included $187,500.00 for amortization, for 1918. The Commissioner allowed $287,361.95 for 1917, and $488,145.53, which included $153,351.24 for amortization for 1918. In passing upon the question presented, the United States Board of Tax Appeals, among other things, said:

"The problem before us is the determination of reasonable allowances for depreciation and amortization of special tools and patterns of the taxpayer for 1917 and 1918. . . .

"Depreciation is, at best, an estimate. That is the reason the revenue acts provide for a 'reasonable allowance' rather than an exact deduction, as in the case of losses, expenses, etc. For the purpose of testing the reasonableness of the allowances claimed by the taxpayer in its amended returns, we have made the following tentative computations, . . . ."

The Board then made its computations, and in stating its conclusions relative to how these computations compared with the deductions claimed by the taxpayer, continued:

"The results of these computations compare with the deductions claimed by the taxpayer (including amortization), in its amended returns as follows:

| | "Our tentative computations | Taxpayer's amended returns |
|---|---|---|
| 1917 | $506.184.15 | $489,438.74 |
| 1918 | $722,188.98 | $776,708.07 |
| Total | $1,229,043.13 | $1,266,146.81" |

Following the above statement of the results of its computations the Board in upholding the taxpayer's claims in conclusion, among other things, said:

"The net difference for the two years is only $37,-103.68, the total shown by our tentative computations being less than 3 per cent lower than the total claimed by the taxpayer's amended returns.

"In view of the fact that there are several elements in favor of the taxpayer, which we have not taken into account in our tentative computations, and that we have made no allowance for amortization of war facilities scrapped before the end of their useful life, we believe that the taxpayer has been reasonable in the claims made in its amended returns. . . .

"The deficiency should be computed, allowing as deductions the amounts claimed by the taxpayer in its amended returns for depreciation (including amortization) of special tools and patterns."

Another interesting decision of this kind was that of the Long Island Foundry Co., Inc., which involved the method of making deductions for depreciation of machinery and equipment, and was also decided September 7, 1925. The facts and circumstances which culminated in the appeal were, briefly stated, as follows:

The taxpayer appealed from the determination of a deficiency in its income and profit taxes for the year 1920 to the amount of $2,540.65. This sum arose from

the disallowance of certain amounts for depreciation of machinery, equipment and other items.

The taxpayer was engaged in the iron foundry business, and made certain deductions for depreciation in its return for 1920. The Commissioner disallowed the depreciation as taken upon its return, which resulted in the deficiency noted heretofore, and the taxpayer appealed. In reviewing the record and passing upon the manner in which the deductions for depreciation should be computed the Board, in part, said:

### Ten Per Cent Allowed

"The total cost of machinery and fixtures used by the taxpayer during the year 1920 was $13,401.51 and a reasonable allowance for exhaustion, wear and tear upon the property during the year 1920 is an amount equal to 10 per cent of that cost.

"The total cost of equipment used by the taxpayer during the year 1920 was $18,830.81 and a reasonable allowance for the exhaustion, wear and tear upon that property during the year 1920 is an amount equal to 10 per cent of that cost.

"During the year 1920 the taxpayer used in its business wood flasks, boxes and bottom boards, which it had built at its own plant at a total cost or $11,959.55 and a reasonable allowance for exhaustion, wear and tear upon that property so used during the year 1920 is an amount equal to 33⅓ per cent of said cost.

"During the year 1920 the taxpayer used in its business iron flasks which it had built at its plant at a total cost of $5,125.52 and a reasonable allowance for the exhaustion, wear and tear upon that property so used during the year 1920 is an amount equal to 16⅔ per cent of said cost. . . .

"The deficiency should be computed in accordance with the foregoing findings of fact. . . ."

In the appeal of the Bear Manufacturing Co., which was also decided by the United States Board of Tax Appeals on Sept. 7, 1925, the question arose as to the value of patents for purposes of inclusion in invested capital and for purposes of depreciation. The findings of fact were, briefly stated, as follows:

The taxpayer was the successor of another company which had paid $7,000 for a certain patent. The taxpayer at the time of its organization had a capital stock of $2,000,000 which was subsequently reduced to $200,000, and divided into 20,000 shares with a par value of $10 each. It paid for the assets and foreign patents of the other company with $106,000 of its capital stock.

### Invested Capital Not Allowed

The Commissioner refused to permit the inclusion in invested capital of any value paid by the taxpayer to its predecessor for patents, or allow a deduction from gross income of any annual charge for depreciation of patents. This resulted in a deficiency in income and profits taxes of $2,637.01 for the calendar years of 1919 and 1920. The taxpayer assigned as errors the above rulings of the Commissioner, and appealed. In reviewing the record and passing upon the questions involved the Board among other things, said:

"Of the two patents acquired by the taxpayer from its predecessor, evidence was introduced as to the cost of only one. For this one the corporation paid Dammon $7,000, and we are of opinion that this represents investment therein for invested capital purposes.

"The evidence shows that the value of $90,000 placed upon the patents by the taxpayer in its balance sheets, and in which sum it issued capital stock therefor, was merely an estimate of the money and labor expended in acquiring the patents. . . . On the evidence we cannot find that the cost of acquisition of the patents, including development expenses to the predecessor corporation, was in excess of $7,000.

"The second question here involved is as to whether the taxpayer is entitled to a deduction from gross income for depreciation of patents. Such deduction, where allowable, must be based on actual cost. On the evidence we hold that the one patent had a value at the date of acquisition of $7,000 and that as to the other patents, the evidence is insufficient to establish value. The taxpayer is entitled to a deduction for depreciation on the basis of $7,000 as the value of this one patent at the date of its acquisition by the predecessor corporation."

## Salesmen Who Know Their Product

By Entropy

About two months ago a salesman came into the plant and tried to interest me in some new steel. I was interested, because we are buying steel in modest quantities all the time, so I asked him the things which I needed to know—to heat-treat it, to secure the highest possible elastic limit, and then what elastic limit I could be sure to get. That was two months ago, and I am still hoping to hear from him; in the meantime we have stuck to our usual steel.

### Delay Loses Order

I once asked a salesman who was introducing variable speed devices what the efficiency of his gearing was at different speeds, and percentages of full capacity. He promised to get the information, and true enough he did, but it was a full six months later. And by that time we had bought a machine that we knew about. Both these salesmen appeared to be men of long experience; they knew their regular patter, but they each claimed that I was the first one to call for such information.

We have heard so much about machinery men doing free engineering, that I want to present these two instances as offsets. It has been my experience running over quite a number of years that for every machinery salesman who really knows his product and its capacity, there are ten who know nothing except what is in the catalogs and the price lists. To tell the truth I would rather dig it out of this literature myself than spend the time having some young man tell it to me, and then have him entirely fail to tell me the things I want to know most of all.

It is refreshing to have someone come in who does know, not his book, but his machine. It seems as though the manufacturer himself is the one who should make tests for efficiency or for endurance or rapidity of production, and it does not seem like asking him to do an undue amount of engineering when we ask for such information.

The way some people go at their sales work reminds me of a shop that I was visiting this summer and where there was no sign of any inspection department. Inquiry as to the reason why elicited the response, "If the stuff is not right the customer will send it back; and if he sends it back it won't make any difference whether we passed it on inspection or not; we will have to accept it."

# Automotive Production

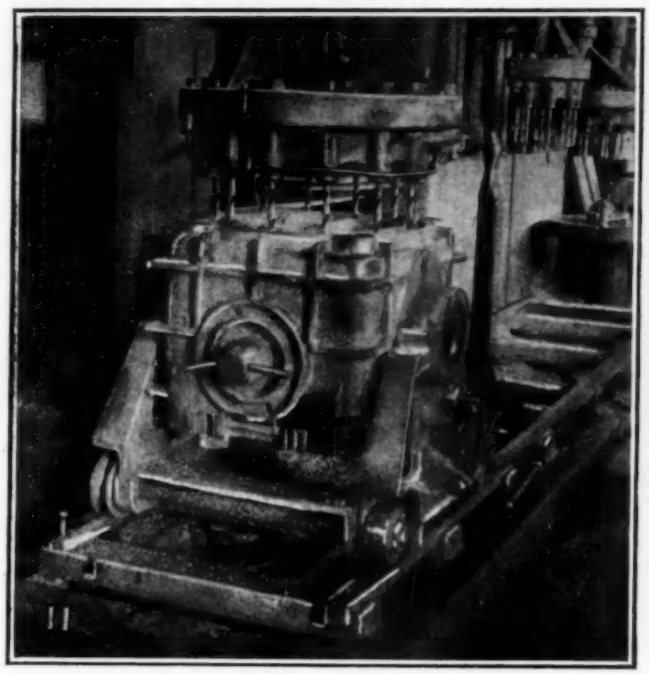


*Fig. 11—Drilling twelve ⅞-in. holes.*

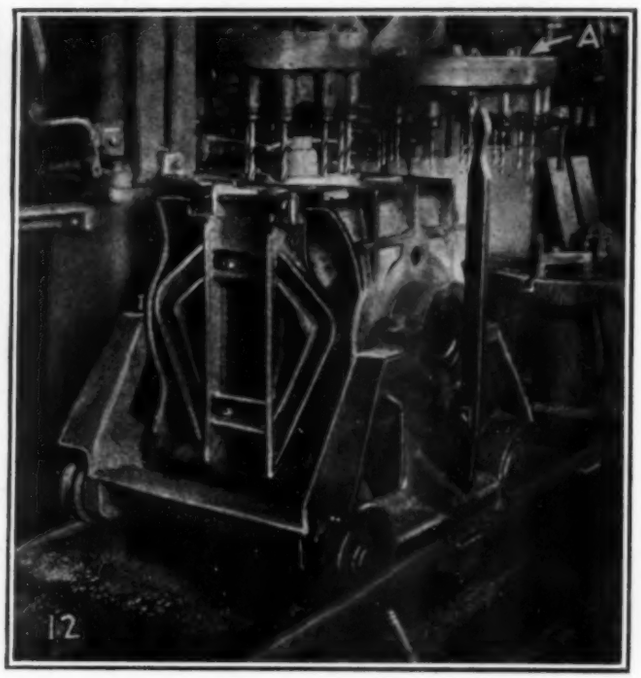


*Fig. 12—Drilling sixteen ⅞-in. holes*

## Machining the Bevel-Gear Housing of the Mack Truck and Bus

**By Frank W. Curtis**
Associate Editor, *American Machinist*

Large trunnion drill jig — Method of driving studs—Inspecting work in group form — Variety of gages used

THE ninth operation performed on the bevel-gear housing at the International Motor Co.'s plant is the drilling of forty holes through four sides of the housing. Fig. 11 shows the trunnion drill-jig used, the track it rolls on and the multiple-spindle heads for the various sides. The jig is provided with a leaf so that the work may be placed inside and located by the two 7-in. bores and clamped by four swinging-hook bolts. On the first machine, a Colburn drill press, twelve ⅞-in. holes are drilled through the flange. The jig is then indexed and rolled to the next machine, a Barnes four-spindle press, shown in Fig. 12. With the first spindle, eight ⅞-in. holes are drilled in each end, the jig being indexed 180 deg. after one set has been completed. The last station is for the drilling of twelve ⅞-in. holes, completed with the head shown at *A*. Details of the trunnion jig are shown in Fig. 13. The leaf *A*, carrying one set of drill bushings, is locked by the thumb-screws *B* and pivoted by the pins *C*. On account of its large size, the construction of the leaf is of ribbed design to insure rigidity and avoid warping. Four hook bolts *D*, swung over the flange of the work, are located in position by the pins *E*. The lever *F* is used for operating the index-plunger. The walls

The second part of the article; the first appeared on page 841.

# AUTOMOTIVE PRODUCTION

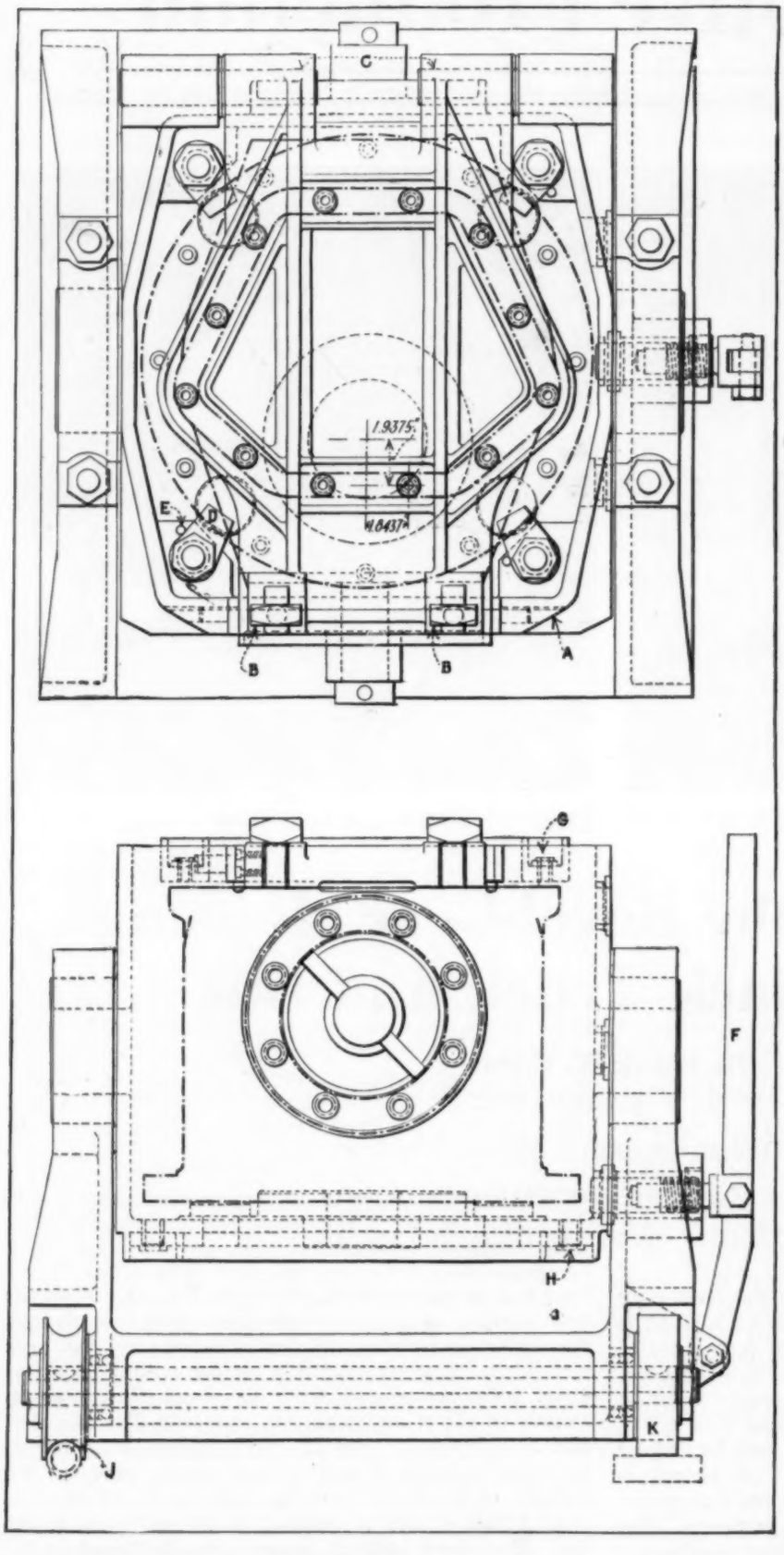



*Fig. 13—Details of trunnion drill jig used in Figs. 12 and 13*

of the jig body, at the point where the bushings are located, are built with a cavity, as shown at *G* and *H*, providing an adequate supply of cutting compound for the drills when in operation. At *J* and *K* are shown the grooved and flat wheels, ball-bearing mounted, the first acting as a guide for the course of the entire jig-unit. The speed of the drills is 81 ft. per minute and the feeds are 0.01 in. per revolution for the $\frac{33}{64}$-in., 0.0135 in. for the $\frac{21}{32}$-in. and 0.012 in. for the $\frac{11}{16}$-in. drills.

In Fig. 14 is shown the set-up for drilling the $1\frac{1}{4}$-in. hole through the flange, operation 10. This is handled on the last spindle of the Barnes drilling machine used in the preceding operation, the work being located on the circular table and held from turning by the stop *A*. The jig plate *B* is clamped on the flange of the work by the handle *C* that tightens a plate on the underneath portion. Two pins in the jig are located in two of the $\frac{11}{16}$-in. flange holes for obtaining the correct position. The drill is operated at 360 r.p.m. with a feed of 0.014 in. per revolution.

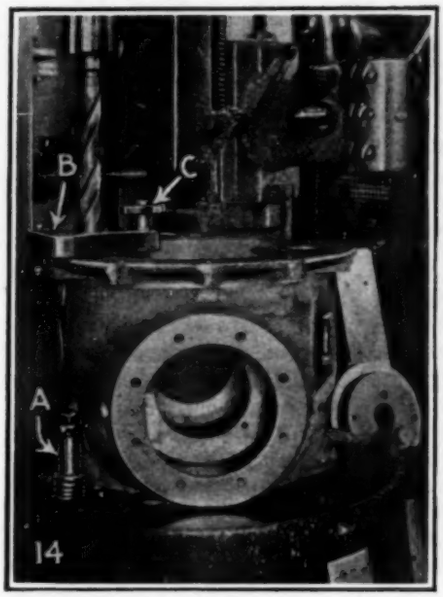
The next operation is similar in that a cored hole is drilled to 2 in. through the flange, Fig. 15. No jig is required, the work being located on the machine table and prevented from turning by the stop *A*. An American radial drill is used, the drill running at 187 ft. per min., fed by hand.

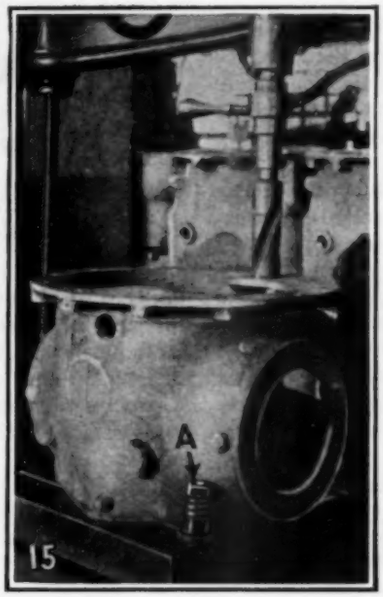
Operation 12 calls for the drilling and tapping of the $1\frac{1}{4}$-in. pipe-plug hole and is performed on an American radial drill, shown in Fig. 16. The work is clamped against the side of the table by the C-clamp *A*. A wood block is used for holding the work in the approximate location until it has been properly tightened. The location of the hole is not held to close limits and no jig is used. The layout for the hole is made, then drilling is done with a $1\frac{13}{32}$-in. drill driven by a quick-change chuck. The tap *B* is used for threading and the thread gage *C* for checking the size.

### Drilling Pad Holes and Driving Studs

The housing is then taken to the American radial drill, Fig. 17, where eight letter-N holes are drilled through the inspection cover, then tapped to 0.368 in.-16 threads and the studs are driven in place. The work

# AUTOMOTIVE PRODUCTION



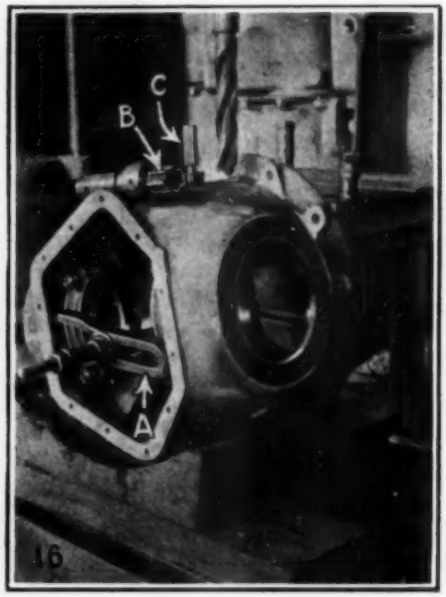
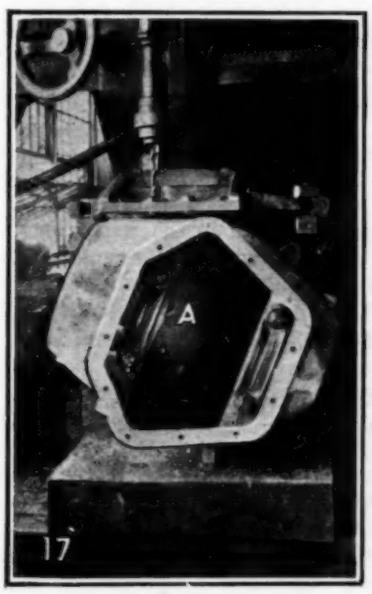




*Fig. 14—Drilling 1¼-in. holes through flange. Fig. 15—Drilling 2-in. cored hole. Fig. 16—Drilling and tapping 1¼-in. pipe-plug hole*

is located on a plug *A*, fitting the 8¾-in. bore, and is held by three sliding clamps. The jig leaf, attached to the rear part of the jig, is swung into place and the drilling is completed. The leaf is then thrown back, a tap and holder are inserted in the Magic chuck and the tapping is completed. Eight studs are started into the holes by hand and are driven into place by a stud driver. Upon removal, the work is ready for operation 12, tapping twenty-eight holes and driving studs, shown in Fig. 18, which is handled on a Cincinnati-Bickford radial drill. An indexing fixture is used for holding the work, as three sides are machined. The work rests on an 8¾-in. plug, is located radially by a smaller plug in one of the flange holes, and is tightened in place by four sliding clamps such as shown at *A*. The first holes to be tapped are the 0.4305 in.–17 thread at *B*, the studs being driven at the same setting. The jig is indexed and eight 0.617 in.–11 thread stud holes are tapped in one end, the studs are driven and the work is indexed 180 deg. for the similar holes that are tapped and fitted with studs, completing the operation. The threads are tapped and the studs are driven at a peripheral 50 ft. per min. As in the preceding operation, the studs are dipped in white lead and are started by hand. This completes the machining work of the housing.

As in the transmission case, the work is washed in a Niagara washing machine, dried by air pressure and taken to a bench for the removal of all burrs from the holes and machined surfaces, in preparation for inspection. The work is placed on special benches and inspected with the gages shown in Fig. 19. The inspector uses the first gage in all the pieces, then the second gage on all the pieces, and so on. The gage at *A* is used for checking the squareness of the flange with the center bore. Feelers are used in connection with it; they are placed under the outer edges of the arms. A maximum tolerance of 0.003 in. is permitted. At *B* is shown the gage for checking the center distances of the bearing-cap holes, also their alignment with the finished surface. It is used before the studs are assembled. The center distance between plugs is 6.25 in. and the diameter of the plugs is 0.008 in. smaller than the size of the drill.

The differential bores are tested with the plug gage *C*, which has a



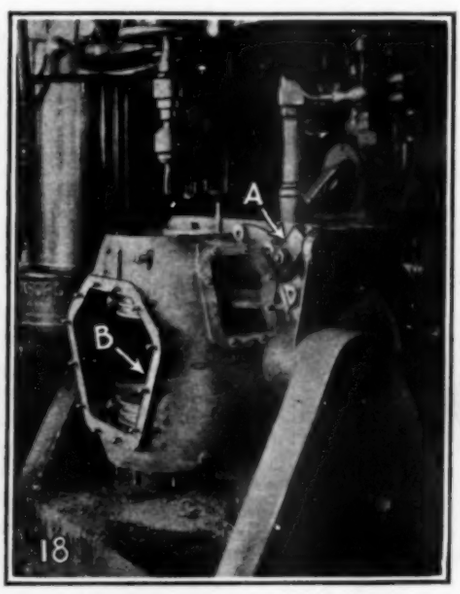




*Fig. 17—Drilling and tapping eight holes in pad. Fig. 18—Tapping twenty-eight holes and driving studs*

# AUTOMOTIVE PRODUCTION

tolerance of 0.001 in. between the "go" and "no go." The larger bearing holes are tested with the plug *D* made to 6.9988 and 7 in. The flange holes are inspected with the gage at *E*, made the actual size of the component that is assembled to the face. The pilot bore is tested with the gage *F*, this bore being the centralizing point of assembly. The limits are 8.7485 and 8.75 in. The length gage at *G* is used for the overall length of the housing, 18.500 ± 0.004 in. The thickness of the flange is checked by the snap gage *H*, having limits of 1.125 ± 0.010 in. The stud location in both ends is inspected with the gage at *K*, made to the actual size of the part assembled thereto.

At *L* is shown the gage used for checking the location of the side-cover pad with the centerline of the housing. The small angular part of the gage rests on the pad and the straight portion on the top face; it has graduations so that the marks coincide with the

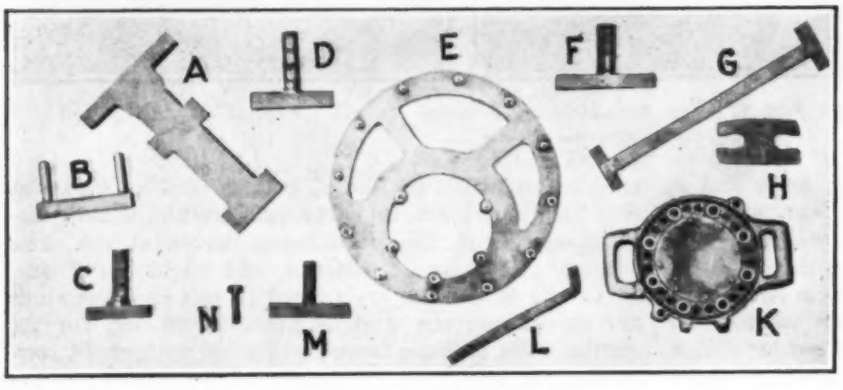



*Fig. 19—Inspection gages used*

center hole. Limits of ± $\frac{1}{16}$ in. are permitted. The plug gage for checking the center distance between the two bearing caps is shown at *M*. The limits are 6.750 ± 0.01 in. The thrust is taken on these surfaces but the take-up adjustment on the differential compensates for the tolerance permitted. At *N* is shown the thread gage for the pipe-plug hole. In addition to these gages is a height gage for checking the distance from the bottom of the case to the top of the bearing-cap sur-

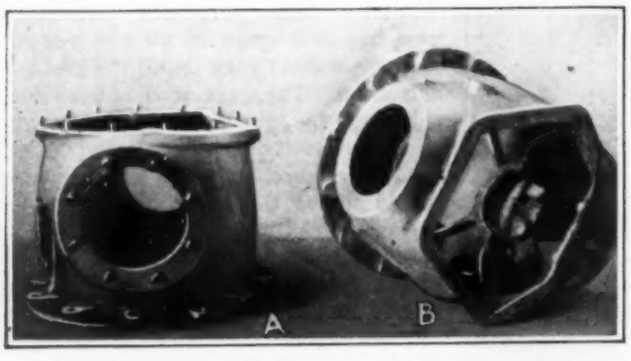



*Fig. 20—Finished housing and a rough casting*

faces. The dimension is 7.779 to 7.783 in. These gages are used on each housing before it is taken to the assembly department.

In Fig. 20 is shown a finished bevel-gear housing, with the studs assembled, and a rough casting as it is received for machining from the foundry.

# Abstracts

## *from other publications*

### Assembly Welding

Welding in its various forms is largely used in the plant of the Heintz Manufacturing Co., Philadelphia, Pa., and L. S. Love describes the results accomplished, particularly in the way of producing some pieces of an unusual character. A special seam-welding machine operating on the arc principle has been developed in co-operation with the General Electric Co. and this machine is used in the manufacture of rear axle housings. Jigs are generally used in the production of difficult stamped and welded assemblies. These not only make for greater speed in production but to a large extent they eliminate the human factor with its tendency toward error, and make close limits and accuracy possible.

A hand-made sample is first produced to make sure of the practicability of the piece before going to the expense of making dies. This hand-made model is put through tests for rigidity and accuracy to determine its ability to sustain the loads to be carried.

In production, the jig itself forms one pole of the arc circuit. Three men usually work on the operation, two loading and one welding. It was formerly the practice to weld a reinforcing strip around the differential housing of the rear axle, but this is now made in a press in the form of a folded flange before the half housing blank is formed. The two halves of the housing are seam-welded in a double-head machine. Aside from the actual welding work which is fast, the machine saves a good deal of time in clamping the two pieces together preparatory to welding.—*Automotive Industries*, Oct. 22, p. 704.

### Bus Maintenance

Ways in which time can be saved in the repair shop are discussed by Lionel H. Williams. Cotter pins and the like should be kept in bins along the benches of the mechanics. The People's Motorbus Co., of St. Louis, uses wheeled stands to support the parts removed from the chassis.

Each axle part removed, for instance, is placed on a stand having a trough to catch the oil drips and is wheeled to the cleaning room.

To test end play in axle bearings a special fixture comprising a wheel stand supporting an axle casting is used. At the bottom of the casing is a pedal, the working end of which bears on the end of the axle to be tested when it has been mounted. Depressing the pedal tends to move the axle in a vertical direction. The axle end play is measured by a dial gage, which reads thousandths.—*Motor Transport*, Nov. 10, p. 12.

# A. S. M. E. Annual Meeting Papers

These papers were presented before the American Society of Mechanical Engineers, New York, November 30 to December 4 inclusive

## *The Question Mark in Machine Design*

**By Forrest E. Cardullo**
Chief Engineer, G. A. Gray Company

ALL problems arising in the design, construction and use of machinery ought to be solved by a rigorous and thorough analysis of the engineering elements involved. However, every engineer who has undertaken to solve very many such problems knows that it is often impossible to express his problem as a mathematical equation or series of equations. If, in order to escape this difficulty, the engineer has recourse to a more general process of reasoning, he finds it equally impossible to assign proper relative importance to elements which usually have no apparent relation, and which are often in serious conflict. He is compelled to choose between trains of analysis that lead to different conclusions, because they are based on different sets of premises, and his difficulty lies in the fact that he knows both sets of premises have in them large elements of truth. The engineer is therefore driven to supplement his analysis by the use of judgment, deciding each knotty element of his problem in accordance with the aggregate of the impressions relative thereto produced in his mind by his past experience. The difficulties just outlined arise from four sources.

### Origin of Design Problems

First, the mathematical treatment required to solve the problem may be too difficult to permit of a solution by the particular engineer, or even by any present-day mathematician. For example, a designer may be obliged to give a complicated form to a part subject to known loads, and because of this complicated form the stresses and deflections produced do not permit of computation.

Second, the conditions of service may not be predictable. No one can tell what feed, depth of cut, and sharpness of tool a workman may use when he operates a machine tool, nor the hardness of the material cut. The assumptions of the designer are guesses pure and simple, and he cannot give a satisfactory reason for them. No bridge engineer can tell how hard the wind will blow, nor can any architect tell how much a snow load will be, nor how heavily a floor will be loaded.

Third, the requirements of service may not be predictable. Who can say that a deflection of 0.005 in. in a machine member is permissible, while a deflection of 0.007 in. is too great? By what process of reasoning does an automobile designer arrive at the conclusion that a level still-air speed of 60 miles per hour is just right, but that one of 55 miles is too low and one of 65 miles too high?

Fourth, the conditions of service may be fully known and the elements may be calculable, but the correct answer for one set of conditions may be entirely wrong for another set. For example, consider a shaft required to run at speeds of both 50 r.p.m. and of 1,000 r.p.m. The proper oil for one speed is entirely incorrect for the other speed. Also the best running clearance for 1,000 r.p.m. is entirely too much for 50 revolutions per minute.

As a result of such difficulties, the designer is frequently obliged to base his design entirely on judgment. Two designers of equal ability will produce two entirely different designs, and if both are candid, each will have to admit that both designs are equally satisfactory, and furthermore, that neither design is what he would like it to be.

Because of these facts, many who are incapable of attempting an analysis of engineering problems believe they are justified in solving such problems by the use of judgment. They do not follow the methods of the engineer, who makes limiting assumptions and then by various trains of reasoning arrives at limits between which his answer must lie, and then chooses his answer within those limits by exercising a judgment in which only those experiences which bear on the problem and that are known to be in accord with the laws of science have any weight. Their procedure is to collect all the impressions suggested to their minds in connection with the problem by any mental process whatever, whether it be association of ideas, similarity of words, the likeness of function, or what not, and then out of this heterogeneous hodgepodge of impressions to arrive at a conclusion which may be, and often is, far from correct. To put it plainly, they substitute guesswork for analysis, and chance for judgment.

### Loose Designing

If engineers had to deal only with one another they would seldom encounter trouble from such loose habits of thought, but since engineering products must be sold to and used by people incapable of engineering analysis and unused to logical thought, the engineer, and particularly the sales engineer, must take account of them. In fact, the sales engineer is often willing to go further than necessary and request changes in design which have no engineering justification and sometimes are disadvantageous because he believes that they will appeal to a majority of his customers. In a similar spirit he will attribute to a good design of his own firm, virtues that it does not have, and to an equally good design of his competitors, faults that it does not possess. Having developed a line of sales arguments having a real but very slight engineering foundation, he often advocates to the engineer that new designs should be developed primarily from the standpoint of his sales argument. This peculiar attitude of mind is engendered because cumulative experience shows him that engineer-

ing products must be designed with an eye to sales as well as to service.

In order to discover the extent of such loose habits of thought, and of their probable effects on engineering design, the author formulated a hypothetical design problem and asked the opinions of a number of persons, engineers and others, all of whom had had mechanical experience, regarding a possible solution. This problem was as follows:

The cross-rail of a planer carries a head for mounting the cutting tool which weighs several hundred pounds. Ordinarily this weight is not sufficient to deflect the rail a measurable amount, so that the work will be sensibly flat when the finishing cut is taken. However, if the length of the rail or the weight of the head be greatly increased, as, for instance, in designing a planer type of grinder for very wide surfaces, this is no longer true, and the problem is presented of guiding the wheel in a straight line in spite of the deflection in the rail pro-

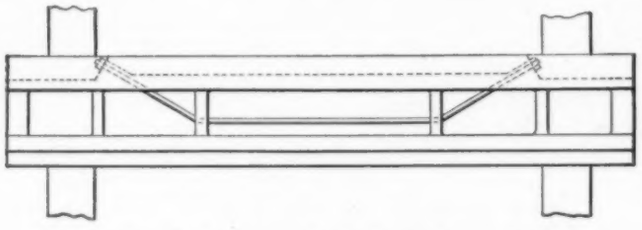


*Fig. 1—Trussed cross-rail of planer type of grinder*

duced by the moving load. One solution of the difficulty is to truss the rail in the manner illustrated in Fig. 1, putting an initial tension in the truss rod just sufficient to keep the path of the wheel sensibly straight as the heavy head passes across the rail.

When the matter was presented to them the engineers all admitted that this was an effective solution of the problem, but were mostly of the opinion that prospective customers would regard the device as a bungling attempt to remedy a defect that ought not to exist, and suggested concealing the truss rod as a satisfactory solution of the problem of sales resistance. The machine users did, without exception, take exactly that view of the proposed device. They all demanded to know why the rail should not be made stiff enough so that there would be no deflection. Some of them refused to believe that this was not possible, *and maintained that any deflection in a machine-tool member was due to "lack of rigidity."* Further questioning elicited the idea that rigidity meant absolute immobility, and that the lack of this quality was due to some defect in the design, material, or workmanship of the structure. Several of those interviewed stated that they preferred the rail without such a device, because it would strain the metal, not realizing that the strains produced would be equal and opposite to those imposed by the weight of the moving head, and therefore would leave the rail casting free from strain under the conditions of service.

More often, however, the engineer encounters the effects of such loose thinking in the erection and use of engineering products. One of the things that gives a great deal of trouble to some machinery builders is the attitude of the average machinery user on the subject of foundations and on the method of attaching machinery to foundations. Machine frames are of two types: Namely, those that have inherent rigidity and so have need of support at three points only; and those without inherent rigidity, which must be supported at intervals in order to preserve their form and maintain perfection of alignment. The average machine user attempts to confer rigidity on machines of the latter type by bolting or grouting them firmly to a foundation. Such a procedure is fatal to the satisfactory use of planers, long lathes, and other machines of that type.

The bed of such a machine should be set on a good foundation, but should never under any circumstances be bolted or grouted to that foundation. Instead, it should be supported on suitable wedges or other leveling devices at intervals of three to five feet. Many shop men, without stopping to analyze the conditions, assume that a foundation will remain true, and that if a machine bed without inherent rigidity be grouted to the foundation, it will add to the stiffness and strength of the bed and eliminate vibration. As a matter of fact, foundations sometimes settle from a quarter to half an inch, and the author has known of planer beds which were forcibly sprung over a quarter of an inch by being grouted firmly to a foundation that had settled. As a result the ways were no longer straight, the table Vs touched only at the high spots, and the bearing surfaces were soon destroyed. Had this machine been set on leveling blocks placed at about four-foot intervals and the leveling blocks drawn up as often as necessary to compensate for the settling of the foundation, the planer would have remained accurate and the bearing surfaces perfect for the life of the machine.

This brings up the question of machine foundations in general. Machine foundations may be divided into rock-supported foundations, pile-supported foundations, and floating foundations. Rock-supported foundations are concrete or masonry structures which rest on rock or hard clay of such bearing power that the foundation does not settle measurably under the load of the machinery. Such a foundation may be in one piece or it may be a series of piers. If such a foundation is obtainable at a reasonable cost, it is the best sort of machine foundation, but even a rock-supported foundation is subject to some seasonable movement, and long beds or frames must not be grouted or bolted to it.

### The Floating Foundation

Where the foundation cannot be carried down to the rock because of the cost or for other reasons, it may be laid upon piles, columns, or beams that are rock-supported. Such a foundation is less subject to seasonable movement, but is more likely to settle at points where it carries concentrated loads.

A floating foundation is one laid on an ordinary earth surface that has been properly leveled and compacted. The foundation must be stiff enough so that it transmits the weight equally to all parts of the surface, and large enough so that the distributed load does not exceed the safe bearing power of the earth. It is usually in the form of a properly designed reinforced-concrete slab. Many persons mistakenly imagine that the supporting power of a floating foundation is proportional to its depth, and spend money unnecessarily for excavation and concrete, or, worse yet, erect machinery on floating piers. Obviously even a good floating foundation may settle, and provision must be made for keeping the machinery level. If the foundation carries only fixed weights, it can support a number of machines with only slight seasonal changes and very little settling. If, however, the loading varies from time to time, as, for

instance, if the slab supports a column supporting a traveling crane, independent slabs should be provided for machines without inherent rigidity, while a common slab will do for a number of machines the frames of which have inherent rigidity.

When a floating foundation is laid near a pile or rock-supported foundation, many masons think that they add to the rigidity and supporting power of the floating foundation by anchoring it at this point to the pile or rock-supported foundation. As a matter of fact, the foundation is then not as good as it would be if it were free from such support, for if the earth settles ever so slightly the foundation will no longer be true; while if the rock foundation be subject to moving loads, the floating slab will continually vary in its lever.

Civil engineers have given a great deal of study to the subject of foundations, and practically all civil-engineering structures are properly supported; but machinery users, instead of designing their foundations in accordance with the principles developed by civil engineers, usually design them by guess.

The bearing is a machine element that has long been in use. Because of the great number of bearings in use, their importance, and their apparently erratic behavior, bearing design has received much thought, and almost every user of machinery has had considerable experience with bearing troubles. Consequently a great deal of misinformation and a great many false impressions are current with regard to the design and use of bearings.

### "Scraping In" Bearings

The best bearing, where it is possible to use it, is a perfectly cylindrical shaft or pin revolving in a cylindrical hole, the hole being larger than the shaft by a sufficient amount to give an oil film of proper thickness. One of the things that is often done wrong is to "scrape in" or "fit" a bearing. "Scraping in" is the old-fashioned mechanical method of making a hole of the same size as the shaft. Therefore a bearing that has been scraped in has no room between the shaft and box for an oil film. Such a bearing invariably runs hot until it has been "run in," that is, until the box has been worn sufficiently large, or the shaft sufficiently small, to allow for an oil film. Since such a bearing does not usually wear to the proper form in running in, it wears too much and becomes loose. The designer attempts to remedy one mistake by another and divides his bearing so as to form two half-boxes, and provides shims that may be removed for closing in as the bearing wears. Half-boxes are often necessary in order to assemble the bearing, but in such a case the two half-boxes should be machined to form a cylindrical hole, and no shims should be used.

While a half-box may be necessary for reasons of assembly, a quarter-box is a mechanical crime. The purpose of a quarter-box may be to provide means of taking up the wear of the bearing, or it may be to provide adjustment by which the shaft may be aligned. It is just as easy to provide adjustment for a whole box or a half-box as it is for a quarter-box. Quarter-boxes wear rapidly because they cannot possibly be lubricated. The load either comes on one of the quarters, which gives an angle of only 90 deg. for support, or else it comes on two quarters and rapidly wears down the point of division between the parts of the box. The cracks at the points of division permit the oil to escape, and prevent the proper establishment of the oil film. In addition to being mechanically incorrect, a quarter-box is a very expensive form of bearing, and any designer will find that if he substitutes for it a properly designed half-box he will eliminate a great deal of his bearing trouble.

Properly designed bearings that have an abundant and continuous supply of clean lubricating oil will show no signs of wear, unless they are required to function under extreme variations in speed. If lubrication is imperfect, or the design of the bearing is such as to produce local distortion, or the bearing operates over an extreme range of speeds, wear may occur. Wear usually takes the form of a cutting or scoring of the bearing surfaces. This may be prevented by making the two rubbing materials of sufficiently dissimilar hardness so that the softest crystals in the harder material are harder than the hardest crystals in the softer material, and then giving the harder material a sufficiently true and smooth surface. The author is aware that this is contrary to the accepted theory of bearing metals, which requires that a bearing metal shall consist of a certain proportion of hard crystals embedded in a soft matrix. However, there is no theoretical reason for regarding a bearing metal of that type as satisfactory, except in comparison with materials that are obviously unfitted to serve as bearing metals. It is obvious, however, that a box and shaft meeting the specifications outlined above cannot cut and therefore cannot wear. It only remains to proportion the bearing area and choose the lubricant and clearance with due regard to the speed, so that the oil pressure shall at no point exceed the compression elastic limit of the soft material.

The author cannot in such a paper as this discuss the theory of lubrication of a cylindrical bearing, or the proper design and function of oil grooving. It must be said, however, that the figure eights, criss-crosses, and complicated systems of reversed spirals with which many bearings are provided, show that their designers are woefully ignorant on these points.

### Lubrication of Oscillating Bearings

There is one type of bearing concerning which there is no satisfactory theory of lubrication, namely, the oscillating bearing, where the external forces do not periodically reverse, or at least relieve themselves. Without such a theory we are obliged to grope in the dark in designing such a bearing, but that is no excuse for adopting the same procedure with other types of bearing where the light is available.

In certain types of bearings, such, for instance, as lathe-spindle bearings, the conditions of service are such as to preclude perfect lubrication at certain times. At the same time it is necessary to maintain correct alignment in spite of wear. Such bearings are often made slightly conical and provided with endwise adjustment to compensate for wear. However, the materials are usually so chosen that it is the box and not the spindle that wears, and since the wear is usually concentrated along one side of the box, alignment is not maintained. If the usual design were reversed and the box made of hardened steel while the revolving element was made of a softer and suitable material, the wear would be distributed around the entire circumference, and correct alignment would always be maintained.

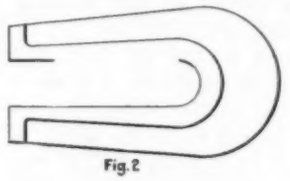
Many design errors have the sanction of high engineering authority. One example of this is the case of the feed mechanisms of lathes, which are frequently over-powered as a result of Mr. Taylor's dictum that the feed mechanism should be capable of developing the same pressure at the tool point as the driving mechan-

ism. The only excuse for this is that in case a tool loses its edge, the feeding pressure on the tool *may* equal the cutting pressure, and the feed gearing will break if it is not proportioned by the above rule. It is equally true that if certain commonly-used tool forms lose their cutting edges, the feeding pressure may equal ten times the cutting pressure, and the feed gearing will break if proportioned by the above rule. The obvious remedy is to proportion the feed mechanism with an ample factor of safety against all reasonable conditions, and then to protect it by a reliable slipping clutch or other safety device.

Another case of a design error hallowed by long and honorable engineering associations is the open-side or C-frame for punches and similar machines. Thousands of innocent engineering students have been taught to design such a frame as a straight beam subject to combined bending and tension. Professors of mathematics have grown gray-headed and round-shouldered trying to figure out how a stress that can exist only along a straight line, can also bend around a half-circle. The answer is that it doesn't and that the C-frame is a mechanical monstrosity.

Were a civil engineer to design a cast-iron or cast-steel structure to act in the same manner as a C-frame, he would not build a structure like Fig. 2, but one like Fig. 3. In Fig. 3 metal is provided to take care of the stresses that actually occur in the structure, the tensions in the flanges being gradually distributed as shears to the web; while in Fig. 2 the stresses in the flange, and between the flange and web, are greatly intensified where the flange is curved.

In setting forth some "horrible examples" the author has not had in mind the idea that these are the particular engineering and design errors which most require



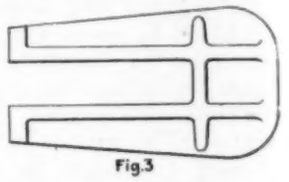




*Fig. 2—Conventional design of open-side machine frame.*

*Fig. 3—Proper method of designing an open-side machine frame*

correction. Rather he wishes to point out the fact that a great many people who are unable to think intelligently about engineering problems are continually influencing engineering work, as customers for and users of engineering products, and that in the main this influence is very unfortunate. Also he has endeavored to point out that engineers themselves sometimes fall into slipshod methods in their work, accepting without question time-worn errors.

# *Safety in Materials Handling*

**By David S. Beyer**
Vice-president and chief engineer, Liberty Mutual Insurance Co.

***Abstract***

AN ATTEMPT will be made in this discussion to give an approximate idea of the seriousness of the accident hazard in materials handling, to determine the principal causes of the accidents and to outline some of the important preventative measures that may be used to reduce these hazards.

According to the definition used by the A.S.M.E., "materials handling" is construed to extend to the "handling of materials of all kinds, raw or processed, in bulk or when handled in individual units; whenever or wherever they are capable of being handled, manually or mechanically." Handling is construed to cover "all movements vertically or horizontally, as continued through distances which would not ordinarily be classified as transportation, including loading and unloading trucks, cars or ships, whether the material is in bales, barrels, boxes, bundles, bags, loose or in bulk, including movement of fluids by pumping or otherwise."

There are more than nine hundred industrial divisions or classifications in our insurance rate manual, such as rolling mills, iron foundries, hardware, cotton spinning and weaving, knit goods, narrow fabrics, etc. In each of these classifications, materials handling is found in some form or other, and contributes its bit to the three million industrial accidents involving one or more days' disability, including 23,000 fatalities which occur in this country every year.

One year's record for Massachusetts (from report of Department of Industrial Accidents for July 1, 1922, to June 30, 1923, inclusive) shows 64,890 "lost-time" accidents with 330 deaths. Materials handling accounts for 37 per cent of the total accidents and 27 per cent of the fatalities. We may accordingly assume that approximately one-third of the accidents, numerically, occurring in industries today are assignable to the handling of material.

The report of Secretary Hoover's investigation of waste in industry places the total economic loss through industrial accidents in this country at more than a billion dollars every year, about one-third of this loss being borne by the employers and two-thirds by the injured employees and their dependents. This indicates that from the standpoint of seriousness, nearly one-fourth of the industrial accident hazard arises out of the handling of materials. Assuming that the time lost bears an approximate relation to the total cost of these accidents, and applying this ratio to the figures quoted from Secretary Hoover's report, we arrive at the impressive total of more than $250,000,000 as the annual economic loss from materials-handling accidents in this country. We thus have a problem that is present in every plant and every industry and one that seems well worth the attention of the engineer from the standpoint of waste prevention alone, entirely aside from its value in preventing human suffering and saving human lives, the value of which can never be adequately expressed in terms of dollars and cents.

When the materials-handling accidents are divided into still smaller groups, it is found that a large number of the accidents that are incapacitating workmen today are precisely such as might have happened in building Noah's Ark or in constructing the pyramids of Egypt. The item of strains in handling objects, for

instance, in Massachusetts represents 30 per cent of the total injuries and 34 per cent of the days lost. An analysis of the strains reported to the Liberty Mutual Insurance Co. during one year showed that nearly one-third of these strains resulted in hernia which involves some permanent weakness, or actual or potential impairment. This seems to point very strongly to the desirability of mechanical means, such as cranes, elevators and conveyors, for lifting or carrying the load that is too heavy for the human mechanism to manipulate with safety.

There seems to be no convincing way of measuring, even approximately, the relative accident hazard of handling the materials by mechanical methods compared with the hazard of handling the same materials manually. The installation of mechanical arrangements is usually a gradual process, extending over a period of years and it is impossible to get many definite accident records covering conditions before and after the installation is made on a comparable basis.

### Reducing Handling Accidents

One specific case where such information is available, however, is a report from the Portland Cement Association, the members of which have done some very admirable work in accident prevention extending over a period of years. One of its members reports that in 1919, when stone was loaded at the quarries by hand, 2.275 days per thousand man-hours were lost on account of accidents; in 1920, after adopting the steam shovel method of loading stone, the time lost was reduced to 0.877 days per thousand man-hours, a reduction of more than 60 per cent. This reduction was maintained the following year at approximately the same rate. We should expect that mechanical handling if properly installed and safeguarded would bring about a noticeable accident reduction.

The principal devices available for handling materials in the industrial cycles are briefly as follows:

1. Special handling systems, vessel or car loading and unloading, coal and ash handling.
2. Cranes, overhead traveling, gantry, locomotive, jib, pillar, monorail systems.
3. Elevators, platform, freight, dumbwaiters, whip hoists, portable elevators.
4. Conveyors, bucket, belt, screw, roller, chain, drag, gravity chute, pneumatic or steam jet, bucket elevators.
5. Hoists, chain, pneumatic, electric.
6. Derricks.
7. Cableways.
8. Track or trackless transportation, industrial locomotives, trucks, tractors, trolleys.

Where the operation applies to heavy, rough or sharp objects improvement is likely to result. Where the materials are light or fine quality, the use of machinery may increase the accident hazard on account of the larger units it permits, the speeding up of the operation and the mechanical hazards introduced. For example, we could compare the old spinning wheel and the modern textile mill. The bakery is another example of increased hazard.

Elevators constitute the most prominent single item in the hazard of materials handling with mechanical equipment. The importance of the elevator as a producer of accidents has long been recognized and many safety codes have been enacted. The fall of persons into elevator shafts constitutes one-third of the days lost, indicating the necessity for proper inclosure of shaftways and the provision of safe elevator gates.

Cranes are second to elevators as causes of accidents. Of the various types of cranes, the electric overhead traveling crane is probably the most general and serious producer of accidents. The fact that so much of the crane equipment is high overhead, where the plant manager seldom or never has occasion to go, probably accounts for the poor conditions that often exist for getting to and from the crane cages or other parts requiring frequent access for repairs and maintenance.

In Massachusetts, conveyors were responsible for only one-fourth as many accidents as elevators and about one-half the number caused by cranes. One thing, however, that can be done to prevent conveyor accidents is to guard all gearing, sprockets, belting, and shafting. For conveyors of the screw type, a hopper should be provided at the feed end to protect the operator's hands. Accidents may be caused by carelessness in putting the material on the conveyor or may indicate the necessity for further guards along the sides of conveyors where persons are working.

A big factor in the industrial accident list is that in the handling of cars and engines where the causes are usually similar to those found in ordinary railroad practice. More than half the deaths in this department are the result of being struck or caught between cars and engines. An item of importance in the prevention of these accidents is a tender on which the switchman can stand in safety. Good safety couplers are also needed, preferably the automatic since it permits cars to be coupled or uncoupled without necessitating the employee's going between the cars. Other accident producers similar to this in nature are those resulting from horse and motor vehicles, water craft, handtrucks and trucks on tracks. Another prominent factor in the list is the cave-in hazard of loose materials piled or stored in bins.

### Saving the Laborer

The use of piping instead of hand-carrying has greatly reduced the list of accidents from liquids that give off vapors more or less irritating or poisonous. Similar measures have reduced the accidents due to chemicals and explosives.

The foreman must use good judgment in directing the handling of heavy materials. He must select a man capable of doing the job without physical damage to himself.

Engineers are in a fortunate situation to secure safe conditions with the minimum expenditure, as they are usually in "on the ground floor" at the time the original construction work is planned. While the drawings are under way, safe conditions can be obtained at the minimum expense, where they may involve prohibitive outlay later on, or be entirely impracticable on account of the structural changes that would be necessary. All drawings for new installations should be checked for safety before they are submitted for bids.

The protection of mechanical and electrical hazards on materials-handling equipment can best be taken care of by the machinery manufacturer. Most manufacturers now-a-days have designed guards which they will furnish when requested to do so, but which may be omitted if they are not included in the specifications. Cranes, elevators and conveyors should be ordered to conform to the national standard that has been adopted. If all the engineers in the country make safety one of the paramount features in the work which they design and supervise, it will add a tremendous impetus to the project of making safe our industries for those who labor there.

# Some Comparative Wear Experiments on Cast-Iron Gear Teeth

By Guido H. Marx,* Lawrence E. Cutter† and Boynton M. Green‡

*Abstract*

THE experiments reported in this paper had their origin in a suggestion of Mr. Luther D. Burlingame and were made in the laboratories of the mechanical engineering department at Stanford University. The gears for the preliminary runs were furnished, at the nominal cost of the castings, by the Pacific Gear & Tool Works and those for the extended runs were donated by the Brown and Sharpe Manufacturing Co.

All of the gears were of cast-iron and had a width of face of 1½ in. No analysis was supplied of the material of the set furnished by the Pacific Gear & Tool Works. Those furnished by the Brown & Sharpe Manufacturing Co. were made from a single pour and of a mixture termed their medium cast iron, being a standard gray iron with 15 per cent steel and having the following approximate analysis according to data furnished by them:

| | |
|---|---|
| Silicon | 2.25 |
| Sulphur | 0.089 |
| Manganese | 0.65 |
| Phosphorus | 0.45 |
| Combined carbon | 0.50 |
| Graphited carbon | 2.85 |
| Total carbon | 3.35 |

All pinions had thirty teeth and all gears sixty teeth. Three types were used in the test: 4-pitch, 14½-deg. involute, standard depth; 4-pitch, 20-deg. involute, standard depth; 4/5-pitch, 20-deg. involute, stub tooth. The apparatus was designed by Prof. L. E. Cutter, and while it has proven entirely satisfactory for the purpose of purely comparative tests, it has shown limitations which would make modifications of design necessary if experiments were attempted to derive actual co-efficients of wear.

By means of the testing apparatus a measured load was placed on one side of the teeth and the test run then made. The load was next placed on the other side of the teeth and a second run made on the same set of gear and pinion.

Before each run the teeth of each pinion and gear employed were carefully measured at radial depths from the top land difference by 0.05 in. Complete dimensions were taken of every tenth tooth, pitch dimensions of each tooth. Ordinary gear tooth micrometer calipers were employed. After a run was completed, the teeth were again accurately calipered and the results tabulated. The differences between the corresponding measurements gave the wear on the chord lines. The run was then repeated with the load on the other side of the teeth. The pitch speed of the gears was 1,270 ft. per min. The loads placed upon them varied from 1,280 lb. to 2,000 lb. The total number of revolutions ranged from 210,944 to 512,000 for each set.

The tests indicated that both standard-depth and stub-tooth, 20-deg. involute tooth forms are better ones to resist wear than the standard-depth 14½-deg. involute form and that the standard-depth 20-deg. involute tooth is superior, also, to the stub-tooth involute form.

*Professor of machine design, Stanford University.
†Associate professor, mechanical engineering, Stanford University.
‡Assistant professor, mechanical engineering, Stanford University.

# Materials-Handling Problems and Their Solution

By F. D. Cambell
Industrial Engineer

*Abstract*

MACHINE processes are today in a high state of development, and if materials handling were developed to the same high plane it would be little in the way of a problem in manufacture.

Granting that its processing machinery has been well selected and is most suitable for the manufacture of the product, and that personnel, organization, and sales are on the best possible plane of efficiency under the circumstances, with cost systems and offices functioning properly, if more profits are to be gotten out of a business, a fertile field for cultivation is to be found in organized handling methods.

The history of a certain moderate-sized plant over several years developed on analysis the fact that profits and expansion were subnormal. The entire structure of the business was well scrutinized and it was found to be in good shape throughout except in that portion involving the handling of the goods. There was no sequence to movement, no related locations of the various operations. Excessive space was used for goods in transit, resulting in low productive value, and there were many handling operations due to the arrangement, thus necessitating much labor for these many motions.

In consequence, the time element of travel was at least four times that absolutely required. The business was just about self-supporting, but not paying dividends. Added capital would not have been of assistance as there was no sound basis for its employment under existing conditions, but it would have been justified if the ratio of income to outgo could have been changed.

The result of the study was that a complete rearrangement was planned which included all necessary handling equipment, and a project was financed to put it into immediate operation. The first year's operation returned more than the initial outlay after deducting fixed charges. The second year's handling expense was practically no greater than that of the first year, though

there was a healthy increase in the volume of business.

The change in the ratio of profits to expense was such that a new program for healthier expansion was possible, and thus the business was literally put on its feet by the use of proper methods of handling. It was planned to amortize the cost of the project, approximately $100,000, in ten years, but the actual returns from two years' operation indicated that it would earn a million dollars in this period, or a net return of the initial outlay annually.

Another instance where new handling methods proved to be a large source of profit was one where expansion in quarters was apparently necessary to handle increased business. Careful examination disclosed the fact that much of the floor space of the plant was unproductive, however crowded it appeared from casual observation. There was a distinct lack of fluidity of material movement through the plant.

A rearrangement was effected that in its very simplicity corrected the troubles. Line flow in sequence was provided, with only sufficient immediate stocks on hand for the minimum elasticity required and to keep pace normally with production orders. The reduction of local storages and aisleways thus brought about approximately a 50 per cent shrinkage in floor space. The "stock in process" inventory was reduced about 75 per cent, the unskilled labor used for handling was almost entirely done away with between processes, any selective change of pace was permitted for seasonal peak periods with capacity for over 100 per cent increase in output, the manufacturing period was reduced very materially, and an order and rhythm introduced that greatly reduced supervision costs.

An automatic conveyor system was the means to this end. The space vacated permitted the emplacement of other contributing departments and so increased the productiveness of the total floor space that several times the initial outlay was returned.

### Uses of Conveyors

In the use of automatic conveyors, advantage should be taken of the principle of gravitation wherever it is suited to the product. For unyielding packages, or articles with one smooth plane surface for contact, rollers may be employed in lines or spirals. However, a large number of articles traveling per minute may cause acceleration to the point of "racing," and at times power control is necessary, particularly in the case of mechanical products or fragile goods. Most types of average-sized packages may be handled on friction slides or chutes, or in friction spirals, where there is not too great a diversity of material in frictional contact. Metal, wood, fabric, and paper have different coefficients of friction, and for any given friction grade proper speed control will not be possible for all coefficients. Belt conveyors may be employed for a general run of products that will not injure the belts, and where high speed and high-capacity movement are desired. This has reference to normal weights and sizes of packages, and belts may run vertical, inclined, or level, with proper accessories.

Belt conveyors running at slow speeds through process also often prove the best carrier medium for all sorts of containers and articles. They are not always limited to size and weight. In one known case, fabric belts in double line carry automobiles in the final assembly. It is a matter of application and the type of carrier—a mechanical question.

In the employment of conveyors using chain there are countless applications. The various manufacturers of these devices issue catalogs that are complete to the point of being textbooks, and no comment is necessary beyond the statement that sizes, weights, and materials unsuited to other types of equipment can in nearly every case be handled on some type of chain equipment. Belt- and chain-conveyor equipment for continuous transportation can be suitably used for movement down, up, and horizontally.

The electric truck is a good distance-hauling medium for the periodic movement of the unit heavy load, and serves its purpose well for traffic between buildings far apart and in moving material of a character not adapted to the fixed conveyor. Economics dictate its use for widespread distribution to many points, great variety of materials, or where the movement is too light to support the larger fixed equipment.

### Types of Equipment

There are many cases where a number of methods and types of carriers are required. Tiering machines, hoists, pilers, portable conveyors, overhead-trolley systems, electric and hand lift trucks are frequently employed to advantage as auxiliaries to the main system, or may be the sole handling medium. Any discussion of their relative merits would be too involved for the space here available.

The continuous type of conveyor is a good investment when used overhead for through routes, or to permit passage or use of floor space under it, as it utilizes unproductive space above and is not burdened with a floor-space charge. Also it may constitute a feed or storage line, thus reducing storage area. There are in existence many such systems of considerable magnitude that carry the entire output almost exclusively under the ceilings, receiving through floors at selective points above them, and discharging by many routes to many terminal points.

Mechanical-handling equipment has found an extraordinarily economical application in the production of goods involving high temperatures in their manufacture, enabling operators to be at remote points and safe from the effect of the heat. Ceramics, glass products, and the vast number of heat applications to metals when mechanically handled make for a variety of benefits. The same is true of spraying and immersion, both for coatings and chemical operations, where these processes are automatically effected on conveyors. The handling of glassware, electric lamps, and other fragile goods can be done with the minimum of shock or injury by mechanical means.

Losses by breakage and high labor cost are big items in the handling of freight and cargoes, and conveyors are rapidly being developed for these purposes, particularly for classified small packages, which represent the bulk of miscellaneous goods.

Any system that is employed in the mechanical handling of material should be well standardized throughout the plant, for the reason that it is not usually left intact for a long period of time. Changes in product, particularly in diversified lines, expansion to include increased business, or correcting of errors in judgment developed by use, often necessitate rearrangement, and the equipment should be designed with such a possibility in view, and in a way to permit changes in relocating, lengthening and shortening, so that the same equipment can be re-employed.

# *Principles and Advantages of Optical Methods for Measuring Machine Parts*

By Henry F. Kurtz

Optical Engineer, Scientific Bureau, Bausch & Lomb Optical Co.

***Abstract***

THERE are four general types of optical apparatus that have been applied to the uses of the mechanical engineer, though by no means have the possibilities of any one type been exhausted. In fact, the field of application has barely been touched.

One of the properties of light that was early recognized is the constancy of its wave length for a given color. Another is its property of interference. The combination of these two properties leads to the fact that each band in a group of Newton's rings represents a very definite minute separation between the surfaces forming the rings. This distance is a function of the wave length of the light used, and so the phenomenon permits extremely accurate measurements of small distances. The optician has checked the planeness of surfaces and has compared curvatures and sphericities by means of the interference principle for many decades, but it is only within the past few years that the engineer has used this method in the making and checking of master gages. With careful work he is now able to compare lengths to within observed differences of a few millionths of an inch with certainty. The application of the principle of the interference of light can doubtless be extended to many other phases of mechanical work through the construction of suitable special apparatus, and the optical engineer is ready to co-operate with the mechanical engineer in its development.

A beam of light which may or may not be modified by lenses and prisms into an image-forming bundle of rays, makes an almost ideal lever for the recording of small movements. The beam of light is a nearly perfect lever because it is imponderable and therefore without inertia, because it is perfectly inelastic, because it is perfectly rigid, because it is without friction and therefore without wear; and it is always easily available. Few mechanical elements have such an array of qualities to commend them.

## Controlling Images

The galvanometer is an example of the widespread application of the optical lever. The mechanical engineer with the help of a cheap cross-hair telescope, a few pieces of mirror, and his own ingenuity could no doubt make excellent use of this device in many places, not only in his laboratory and test room, but in the shop.

With the help of lens systems we may control beams of light in such a manner as to form images of objects that we may wish to observe. These lens systems may be designed by a skilled optician to give an image many times larger than the object itself and with a very high degree of geometrical similarity between the image and the object. Obviously the errors of the object are magnified to the same degree, and they become correspondingly easier to observe and to measure.

One of the most serviceable arrangements is that of the projection system, which is coming into use because of the ease in observation, no eyepiece being required, because large magnifications are easily attained, and lastly because a photographic plate may be inserted in the image plane and a permanent and accurate record made of the conditions under investigation.

The microscope together with an eyepiece micrometer makes an admirable device with which to measure small distances. A scale may be made, the least interval of which is equal to the range of measurement of the microscope micrometer, and the two, microscope and scale, incorporated in an instrument for measuring distances with considerable accuracy up to the length of the scale. The scale may be divided on a material for which the temperature coefficient is known and a temperature correction applied, or it may be divided on invar steel which has a sensibly zero coefficient. The scale may be checked by an adequate means at hand or may be checked by the U. S. Bureau of Standards at small cost, and a correction graph or table constructed to correct for accidental or systematic errors of graduation. When this scale is incorporated in a measuring instrument it may be enclosed completely, hermetically if necessary, and observed through a glass window. The scale, then, is completely protected against abrasion or wear of any kind, and is everlasting. The scale, which is the basis of measurements, will last indefinitely and its corrections never change. It will outwear any number of instruments.

## The Optical Lever

The use of the optical flat together with gage blocks for the comparison of lengths is so well known that it is not necessary to describe the method and apparatus here. It is mentioned only for completeness. The same principles with the aid of interferometric apparatus can undoubtedly be further applied to the accurate measurement of small dilations and other quantities.

The optical lever consists of a mirror pivoted in such a manner that it will rotate about an axis in the plane of the mirror under the impulse of the motion of the member under investigation. The image of a distant scale formed by this mirror is viewed with the aid of a cross-hair telescope. The length of the pivot arm and the distance from mirror to scale then form the two arms of a lever, the ratio of which is limited only by vibration of the apparatus.

The angle-measuring tools used by the tool maker are usually provided with scales and verniers divided on steel. The verniers are hard to read for the average mechanic, the lines are coarse and conducive to inaccuracy, and the scales are susceptible to damage by abrasion and corrosion. Advantage of magnification has been taken recently in the use of a glass scale, divided to fractions of a degree, and a single-line index by means of which angles may be accurately estimated to 5 minutes of arc. For linear measurements the scale is divided to read fractions of an inch, either by means of a single line or an eyepiece micrometer. The scale is completely enclosed and protected against abrasion, and the elimination of the vernier reduces the setting and reading to the lowest terms of simplicity.

# *The Tension Radio and Transmissive Power of Belts*

By C. A. Norman
Professor of Machine Design, Ohio State University

***Abstract***

IN 1885 Wilfred Lewis published some tests on the transmissive power of leather belts which still remain fundamental and noteworthy and have served as the starting point for remarkable analyses undertaken by Carl G. Barth and others.

The tests were carried out by means of running belts and the initial tension as well as the effective pull, the tension ratio and the slip were determined and recorded. Lewis' results showed the dependence of the tension ratio on the velocity of slip and indicated that with increasing slip the tension ratio increases, at least within certain limits. In other words, the greater the slip, the greater is the percentage of the maximum tension converted into effective pull.

Lewis' results were obtained at a belt speed of about 800 ft. per min. and with the same pulley, 20 in. in diameter, therefore, there is no reason to ascribe the increased tension ratio to any other influence than increased slip, and, possibly, to increased power transmitted.

## Work of Prof. Kammerer

In 1907 and 1912, Prof. Kammerer of Charlottenburg published the results of tests undertaken with pulleys varying in diameter from 600 mm. (23.5 in.) to 2,500 mm. (98.5 in.) and with speeds running up to 12,000 ft. per min. From these tests the conclusion was drawn that for a variety of reasons the co-efficient of friction apparently increases with the belt speed. One reason was thought to be that at higher speeds the belt has less time to stretch and hugs the pulley more intimately. This reason seems to be borne out by the fact that at high speeds and high loads the pull on the shafts (i.e., the sum of the tensions) was found to be much greater than expected, if an allowance is made for centrifugal force. Kammerer found, however, that the pulley diameter had a great deal to do with this matter. He pointed out the practice of the belt firm of C. Otto Gehrckens in Hamburg, which allows an effective pull as high as 90 lb. per in. of width for belts running at 10,000 ft. per min. on pulleys 79 in. in diameter but only 50 lb. for pulleys 12 in. in diameter. The tests of 1912 likewise contained experiments designed to find out at what tensions a belt can run without the stretch growing permanently and in an undue manner. Values were arrived at closely agreeing with Gehrcken's practice.

Of especial importance is that these tests were made on fabric belts as well as those of leather. Kammerer arrived at the conclusion that textile belts generally could not profitably be run at speeds of over 5,000 or 6,000 ft. per min. However, he ascribed the drop in transmissive power at higher speeds to the centrifugal pull of the metallic belt joint. At speeds below 5,000 to 6,000 ft. per min. the difference in permissible effective pull between textile belts and leather belts was not very great. The textile belts included balata and camel's hair belts, but not rubber belts.

Kammerer also made tests from which he concluded that leather belts with the hair side to the pulley did not permit as high speeds as belts with the flesh side to the pulley. In America the general practice is to run the hair side on the pulley and tests of R. F. Jones, published by the Leather Belting Exchange, indicate this practice to be fully justified. He did not use speeds over 3,200 ft. per min., however, so the results need not be considered, necessarily, as inconsistent.

In order to eliminate the influence of belt speed and belt stretch entirely, A. Friedrich undertook tests with a stationary belt hung over a slowly revolving pulley. The pulley, of 500 mm. (19.7 in.) diameter, was made to revolve at speeds such that the relative velocity between the pulley rim and the belt corresponded to ordinary slip velocities. He found that the tension ratio varies with the slip in very much the same way and between the same values as Lewis found. There is, therefore, little reason to assume anything else than that the slip is at least the main factor tending to make the transmissive power of a leather belt increase with increased speed.

Friedrich assumed that the tallow, or other internal lubricant is partially melted out by the heat generated by the slip and that in this way a semi-fluid friction is generated. Such a friction would increase with the slip of the fluid layers on each other. He observed that a greasy speck on the pulley increased the friction when spread out by means of rubbing with the finger.

## Leather Belting Exchange Tests

If this, however, is true, it would seem that fabric belts would not possess the property of a transmissive power increasing with the slip. Tests conducted under the auspices of the Leather Belting Exchange and published in pamphlets issued by that organization for its members apparently confirmed this conclusion. While leather belts in these findings show a transmissive power increasing indefinitely with the slip, the fabric belts show a breakdown point at which the slip increases without increase in tractive power. The breakdown point for some kinds of fabric belts lay much below the load recommended by manufacturers of such belts.

Since this situation seemed anomalous and not in perfect agreement with Kammerer's tests, the Engineering Experiment Station of the Ohio State University was induced to conduct tests on a machine of the type used by Friedrich.

The conclusions drawn from the tests are that the transmissive power of belts on cast-iron pulleys shows in general and within certain limits a tendency to increase with the slip. This tendency is especially marked in the case of certain mineral-tanned leather belts and of oak-tanned belts which have passed through a running-in period. It occurs, however, also in the case of rubber belts, balata belts and various impregnated textile belts.

In the case of certain rubber belts and balata belts the

increase of transmissive power with slip reaches a maximum beyond which no further increase takes place. The percentage of maximum tension turned into effective pull may, however, remain creditable even beyond this point. In other words, the belts do not need to be over-tightened.

The percentage of maximum tension turned into effective pull is greatest for the special mineral-tanned belts investigated. It is very high also, especially at some slip, for a leather belt that has been run for a short time and it is high for balata belts. It exceeds 60 and even 70 per cent for some rubber and impregnated fabric belts.

### Efficiency at Start of Service

New oak-tanned leather belts, not run in, convert into effective pull a smaller fraction of the maximum tension. Rubber belts, balata belts, certain textile belts, and the special-mineral-tanned belt give their full service from the very start. A few months of running does not seem to impair the transmissive power of rubber belts.

These conclusions are, of course, strictly applicable only to the belts tested and to the test method used. The results seem to agree with certain tests on running leather belts, however.

In a test conducted by a commercial concern it was found that a greater slip was required to produce a certain tension ratio with increased speed and that the tension ratio rose with increasing tension.

Both these modifications occurred because the slack side of the belt was on top and the greater the slack, the greater was the angle of the contact and hence the tension ratio. With increasing speed however, the centrifugal force would tend to "open up" the belt. This condition led to a smaller effective angle of contact with increasing speed and a smaller tension ratio.

## Largest Rotary Gear-Tooth Cutter

What is believed to be the largest rotary gear-tooth cutter ever made was recently furnished by the Union Twist Drill Co. of Athol, Mass., to the Farrel Foundry & Machine Co. of Ansonia, Conn., to cut the pinions for an unusually heavy sugar mill drive.

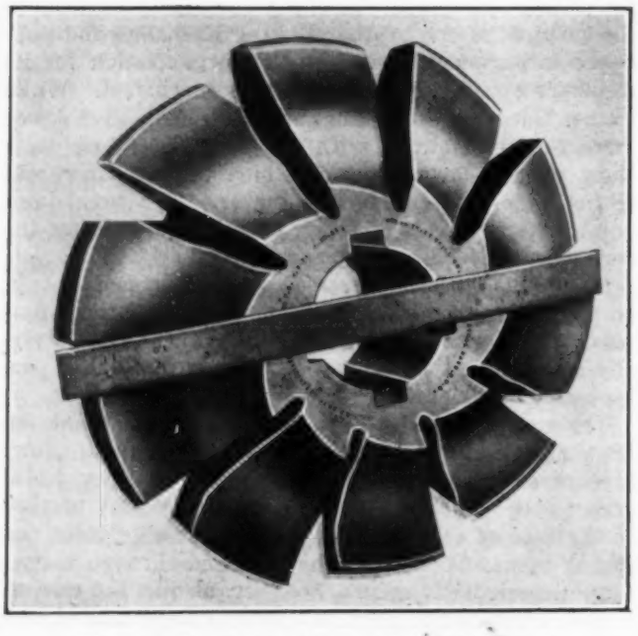


*Fig. 1—The big cutter and a 12-in. scale*

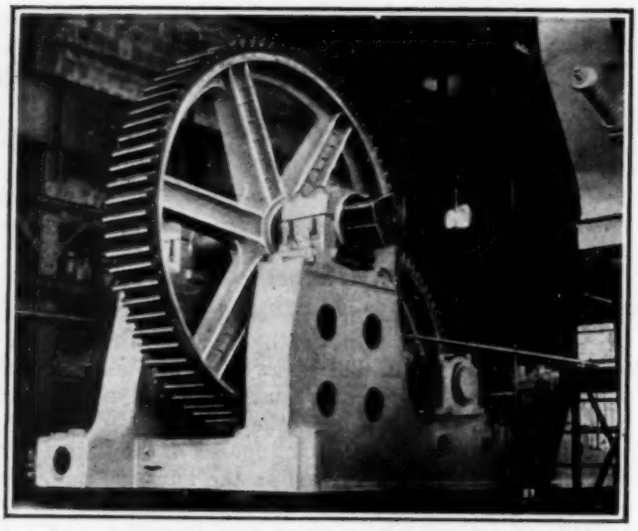


*Fig. 2—Assembly of gears of the type for which the cutter was made*

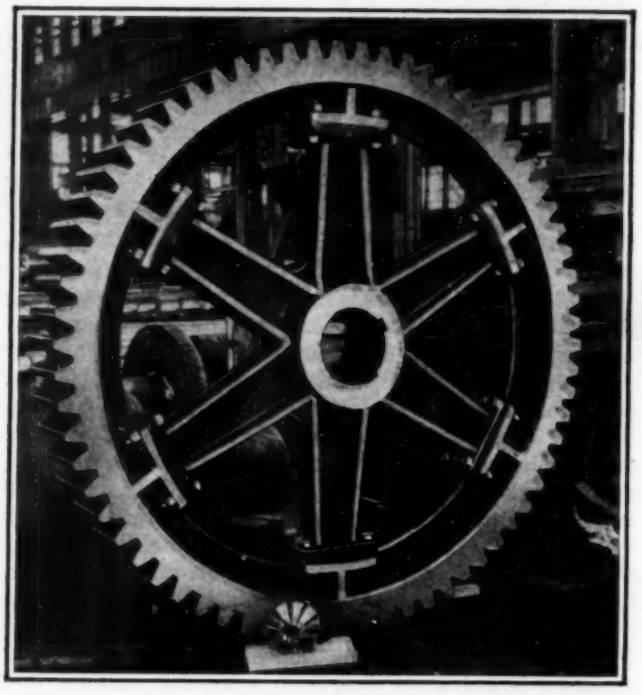
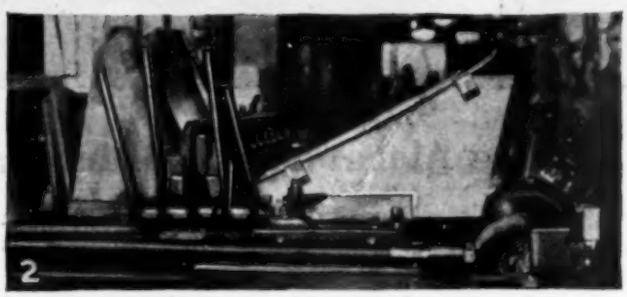
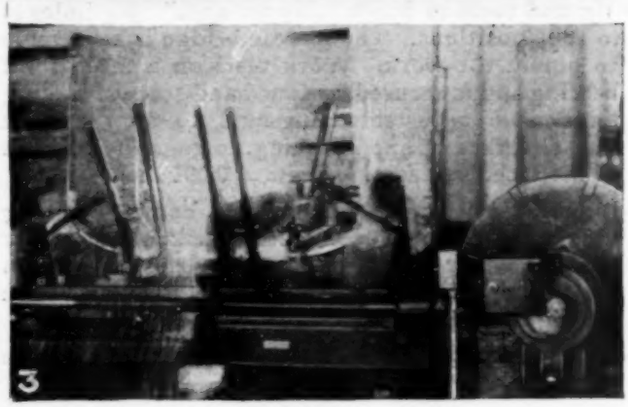


*Fig. 3—A rough idea of the relative size of cutter and work*

The cutter, shown in Fig. 1, is made from a single piece of Rex AA steel. It is 12½ in. in diameter, 5 in. through the hub, and weighs 92 lb. The bore is 3 in. in diameter. The keyways extend longitudinally through the bore, and there is a radial keyway at each end of the hub. It is of 5-in. circular pitch, 20-deg. pressure angle, and designed to cut from 21 to 25 teeth.

The large gears, Figs. 2 and 3, cut with the mate to this cutter, were of 152.76-in. pitch diameter, 18-in. face, 96 teeth, and weighed 14 tons each. They were steel castings. The cutter is, of course, of the same characteristics as the one here shown, but as it was designed to cut the larger number of teeth it is slightly narrower at the hub and weighs somewhat less than the one illustrated.





## Electric Welding in Various Manufactures

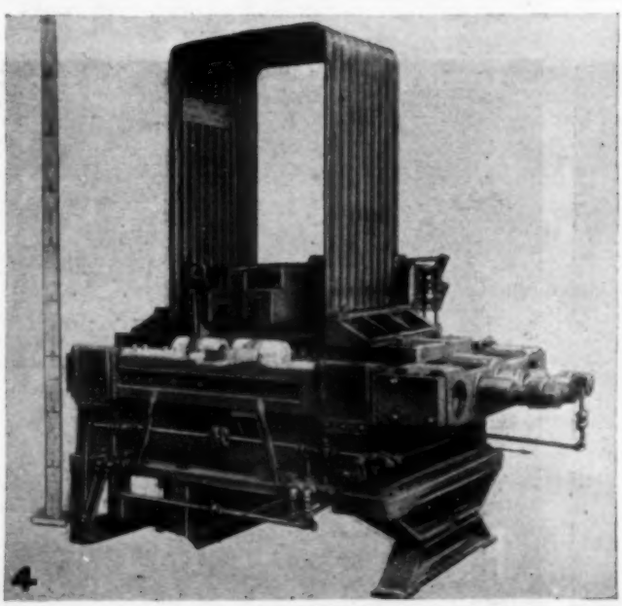
1—*Arc welding a tanker—General Electric Co. apparatus.*

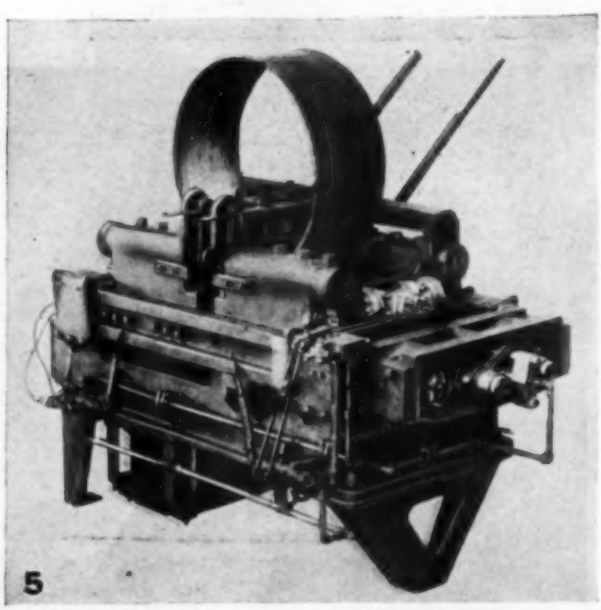
2—*Winfield butt-welder for motor-body work.*

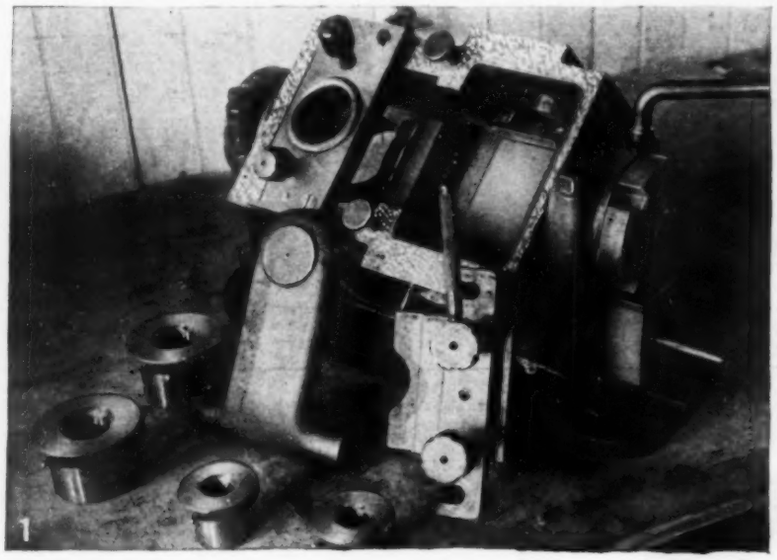
3—*Same welder on cowl sheets.*

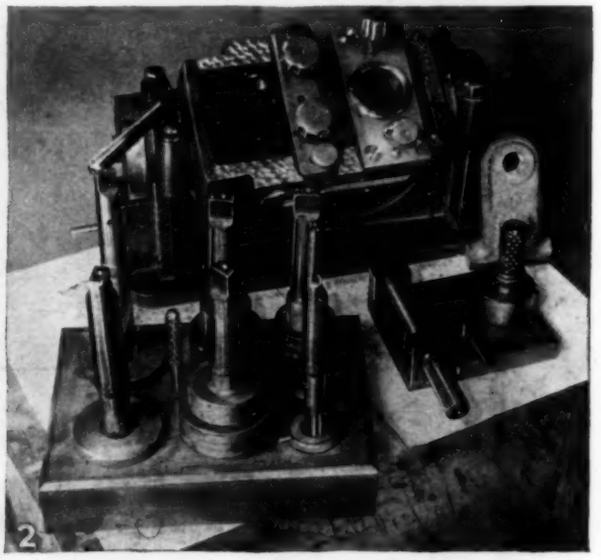
4—*Federal butt-welder on truck body 30x60 in.—½-in. thick.*

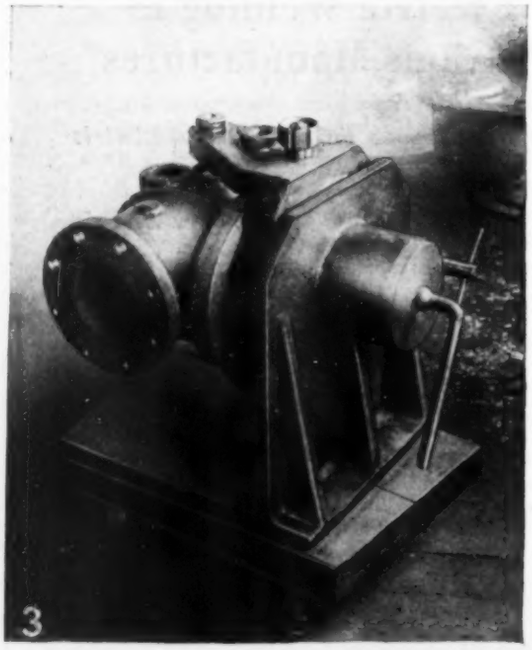
5—*Federal butt-welder on drum having 3 sq.in. of metal.*











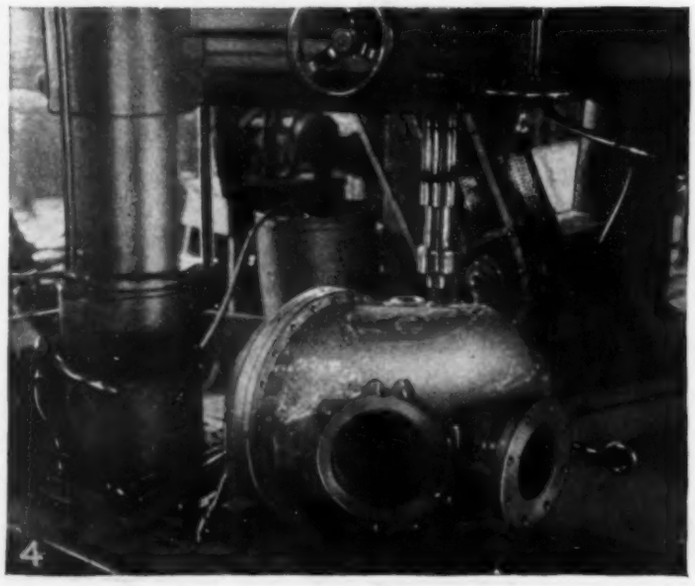
## Making Alarm and Dry-Pipe Valves

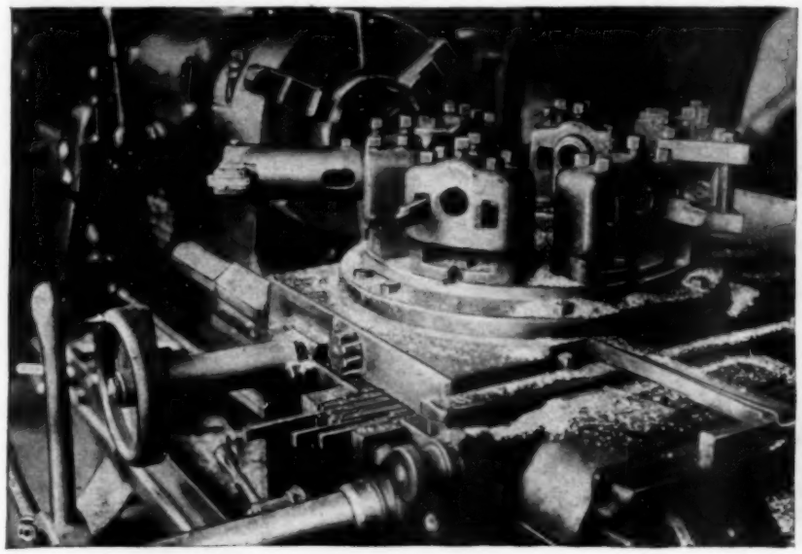
1—Jig to drill, ream and face "clapper-arm" for alarm valve. Middle bridge shown removed. Facing tools same as in Fig. 2 but larger.

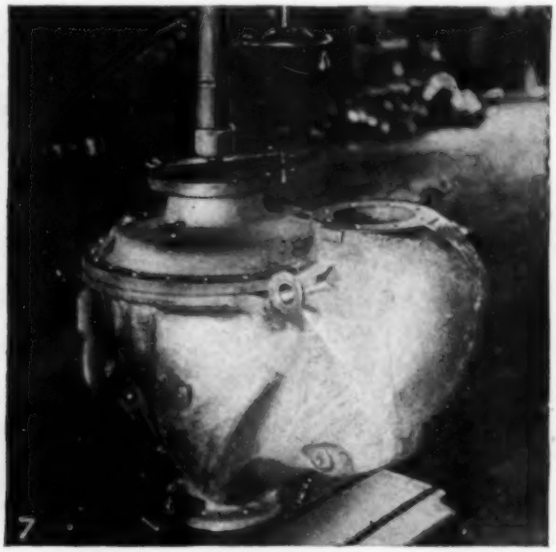
2—Jig and tools to finish "clapper-arm." Jig indexes to four positions. The middle bridge is removable to put in the work. Work rests on a three-point bearing and is secured by four hand-screws. Facing tools have adjustable ring-nuts to stop against upper surface of fixed bushing, to gage the relation of the faced surfaces. Limits ± 0.001 inch

3—Indexing drill jig for alarm valve body. Each jig has a small four-wheel caster-truck on which it remains when not in service. Height of truck is the same as the base of the radial drill on which the jig is used

4—Drilling and tapping 6-in. automatic dry-pipe valve body







## For the Rockwood Sprinkler System

5—Machining "base" of valve. This side finished all over at one setting. The operation includes facing a tin seat in a groove and boring for a bronze ring that forms a seat for another part of the valve

6—Machining bronze base-ring for automatic dry-pipe valve

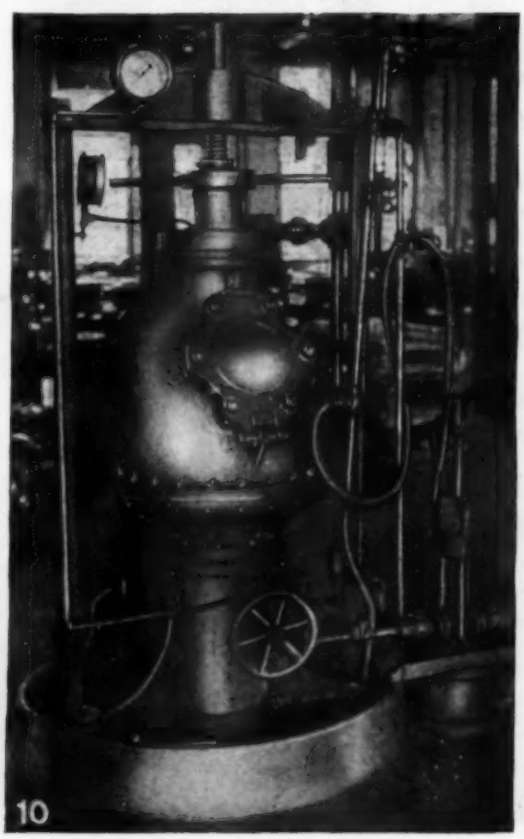
7—Lapping base to body of dry-pipe valve on radial drill. Flour-abrasive and oil used

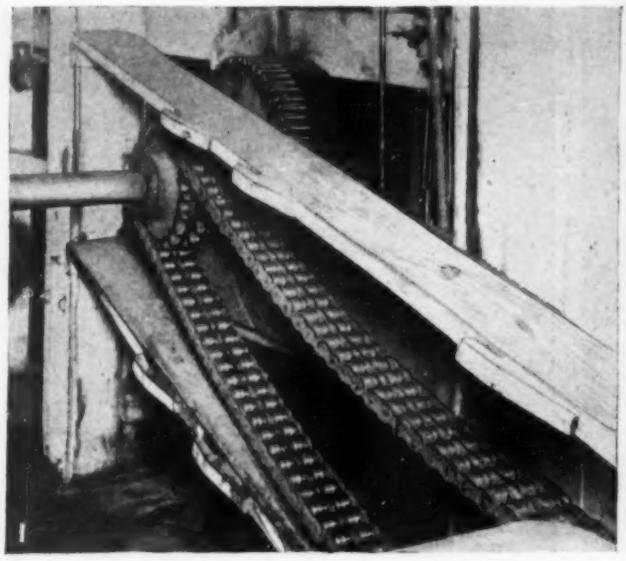
8—Hand-lapping the bronze "disk" of the dry-pipe valve to its seat with ground glass and oil

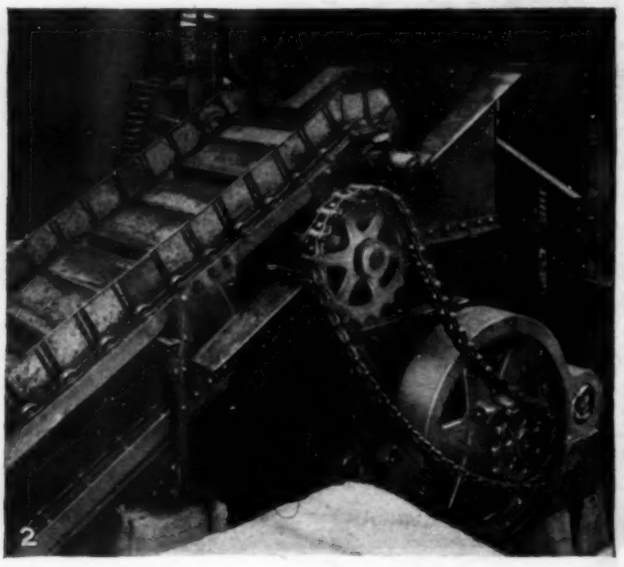
9—Assembling dry-pipe valves

10—Testing a dry-pipe valve with water at a pressure of 250 lb. applied with hand pump

Photographs by courtesy of the Rockwood Sprinkler Co., Worcester, Mass.







## A Variety of Chain Drives

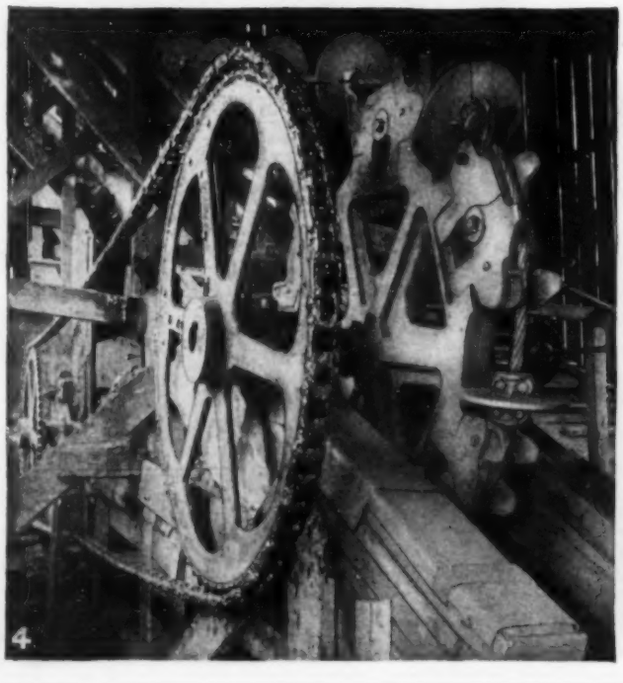
1—Link Belt drive from lumber mill to boiler

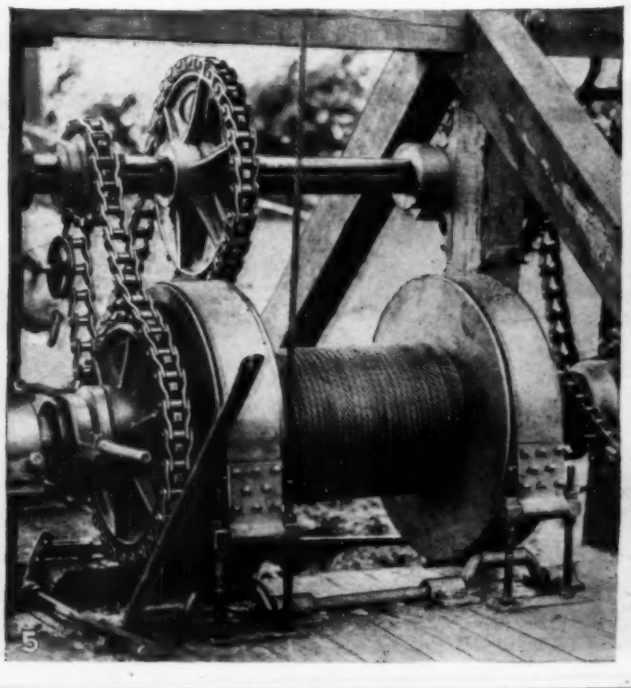
2—Jeffrey drive from crusher to feeder

3—Link Belt drive on amusement park thriller

4—Jeffrey drive on conveyor

5—Link Belt drive on oil-well rig





# Dealing With the Outside Inventor

By E. W. Leach and J. F. Koch

## Problems of making contracts with the inventor — Selling through sales organizations — Inventors as sales agents — Employment and remuneration of the professional inventor

THE moment a manufacturer lets it become known that he is seeking some new product to help absorb the capacity of his plant, there seems to be some mysterious underground channel of communication by means of which that fact is passed along to every aspiring industrialist in the seven neighboring states.

The plant with which the writers have been connected for the past ten years is just emerging from the disastrous effects of a concerted siege on the part of the well-known organization of "Bug House Inventors, Incorporated," so we know whereof we speak. Our own experiences, together with those of others, cause us to believe that a bit of dearly purchased knowledge may be of benefit to the readers of the *American Machinist*.

Perhaps the best way to study the problems which arise in taking on new products is to consider the various ways in which contracts are drawn with outside inventors, and then to investigate the good and bad points of each method. We will deal, therefore, in concrete illustrations, founded on actual fact.

### Who Pays the Bills?

Inasmuch as you are trying to fill your plant with additional work, the outsider will naturally want you to do all the manufacturing. That much is obvious. This is something to think about at the very start. In order to manufacture goods one must have a factory building, machine-tool equipment, raw materials, and men on a payroll. Those things require money. Goods can be sold without even a sample case or a piece of printed matter, if one has to do the job in that way. Notice, then, whether your man is putting up to you the part of the task that takes all the capital, and leaving for himself the end of it that can, under necessity, be accomplished with practically no investment at all. This is something to think about in determining the amount or the basis of compensation for the inventor of the product. These men usually have a way of locating you at the precise moment when their product is entirely ready for the market, and when they have just run out of the last bit of their own money. If it were not for the fact that the whole proposition only needs a few thousand dollars more to put it over the hill, you would never be offered the opportunity of sharing in the ground floor distribution.

It is all right for you to hold the bag, if there is a reasonable guaranty of profit for you in so doing. But don't permit yourself to be carried away by the enthusiasm of a man who is naturally expected to be wrapped up in something he, himself, has designed. These men are mechanics, not salesmen, and their word must not be considered too seriously when they are painting the potentialities of their invention. It must not be expected (as the inventor usually believes) that competitive sales will drop to zero the moment the bombshell of the newer design is presented to the trade, granting that his article may possess merit, even assuming that it is superior in some respects to competitive articles already on the market. Many an excellent product has died begging for buyers, simply because it was not backed up by constructive advertising and sound merchandising methods.

### Methods of Marketing

The selling of the new product may be considered in three different ways. First, the inventor may wish to sell it himself as an individual; second, he may want some separate and outside organization to do the sales work; or third, he may want you to do the selling as well as the manufacturing.

The first method is a very poor arrangement, and one that should never be considered at all. We think of an instance where a manufacturer undertook the marketing of an automatic gas water heater for homes. This was in a city where about 75,000 homes were served with gas. The inventor said, "Why, just think, if we only sold ten per cent of them a year; it would add over a quarter of a million dollars to your sales. And that can be duplicated in every other city of any size in the country!"

The inventor himself secured a position with the company as a salesman. He was to have complete charge of the sale of his product. According to his dreams, you can imagine how soon the company would require the resources of a Henry Ford in order to meet the demand for its gas water heater. In actual fact, however, the inventor of the heater did not sell a dozen installations of his own device.

The reason is evident. All business activities throughout the world are divided into two chief groups —production and distribution. All men, by reason of natural aptitude, must choose the group in which they are best fitted to serve. A man is either by nature the mechanical, inventive type, or he is the advertising, selling type. It is rare, indeed, that the two types are found in the same person.

This particular gentleman was not the selling type. It is not to be wondered at, therefore, that his last adventure in salesmanship was to make telephone appointments with doctors, leading them to believe he was calling as a patient, and then taking up their valuable time in trying to sell them gas water heaters. One can guess what ill-will this sort of thing created.

The manufacturer in question woke up to find in his

factory more than $6,000 invested in jigs and fixtures for making a product that he invoiced at less than $50 each. The article unquestionably had merit, and here was a big investment that must be washed out in some way. So he turned to the second method of selling, which is often the first to be suggested; namely, that of turning the sale of the product over to a separate organization.

This method has its good points. It is satisfactory if the other company is financially established and responsible. Too often, however, the only assets are a sales contract and a bit of office furniture. These assets are all right in a going concern; but when a flat tire develops, the manufacturer is usually left with a good sized account receivable which he cannot collect and against which there is no tangible security.

### Caught in the Shower

This was the unfortunate experience of the manufacturer whose experience we are citing. The head of the sales company, it later developed, had nearly $100,000 in judgments hanging over his head in another part of the country. He was a good salesman, so far as the art of closing a sales was concerned. But the most important part of the word "salesman" is the last part of it, "man," and as a man, this fellow was totally unreliable.

He chose for the name of his company a name very similar to that of the manufacturer. This was an evident attempt to take advantage of the manufacturer's prestige and credit standing. Concerns extended large credits, thinking, of course, that they were dealing with the parent company. About two hundred installations were sold, and when the crash finally came, it was discovered that all the time payment contracts had been assigned to a finance corporation, and that there was not a big enough equity in any of the equipment to complete the payments. Our soldier of fortune probably realized just enough money out of the whole thing to pay for transportation to some new field of exploitation.

The manufacturer is now trying to sell the device himself, with his regular organization—something he should have done in the first place. But apparently he is a couple of years late in getting started. About the most profitable use that can now be made of all the jigs and fixtures is to seal them up in a glass case at the club rooms of the local Civic and Commerce Association and to label the exhibit prominently with the well-known admonition, "Before you invest—investigate!"

Some of our readers may say, "Oh well, that must be some small-town manufacturer. No one with any brains would let himself get caught in a mess like that." We can assure you that these things are happening every day to the large concerns as well as the small ones, thus proving again the brutal truth of the famous remark, "The bigger they are the harder they fall."

"But," you may say, "We are not looking for additional sales work. What we want is production volume. We are making automobile accessories; what do we know about selling a household appliance?"

Very well, if that is your attitude, then go after straight jobbing work. Solicit your work from established organizations who can refer you to every banker in the city. Know where your money is coming from, and get it when due. But if you are going to take over the manufacture of a new product; if you are going to give it your own name, and put your own reputation and business future at stake, then for the sake of that reputation and future, get as much of the distribution of that product under your own control, and subject to your own management as you possibly can.

Before passing to our next subject, let us summarize just briefly these three methods of selling a new product.

First: the inventor wishes to do the selling under your name. The question is, is he a salesman, is he capable of the task?

Second: the selling is to be done by some outside organization. The question here is, are they responsible? Do you care to set your own investment up against the risk of their not being able to sell the goods.

Third: do the selling yourself. Surely this method provides the greatest amount of protection for the manufacturer.

The most important point in any negotiations of this kind is to determine how the inventor is to be compensated. Here is where the big discussion will take place.

The inventor may want to come into your organization and to be a part of your payroll. We have already pointed out the poor practice of employing him as a salesman. Knowing every conceivable detail of his product's construction, he will roll off unlimited selling talk about how the product is built, whereas the prospective purchaser is more interested in knowing what it will do for him. It is more interesting to a manufacturer to know that with a high-speed drill one can bore more holes with less resharpening, than to know merely how the drill is made.

### Employing the Inventor

About the only other place of possible usefulness is as an experimental man. He may suggest that the particular article he is offering you is but one item in a complete line of goods that he can produce if he has the proper freedom and the proper facilities.

One has to be quite cold-blooded under these circumstances. If the man can really fit smoothly into your present organization, and if you can really make profitable use of him, by all means employ him. But if his contemplated program of inventive development degenerates into a process of "puttering around," then the effect on the rest of the men will be very bad.

Invariably these outsiders will expect a much higher rate of pay than any of your most capable mechanics. Their attitude around the plant is usually one of superiority. Having once had a contact with the general manager of the company, they dislike to submit to the authority of mere foremen and superintendents.

The best spirit is preserved in any organization by a policy of promotion from within the ranks. One never knows what may be going on in the mind of some fellow who has been with you for five or ten years. You cannot tell what he may have dreamed about during that time. Perhaps if you were to put your problem up to such old-timers you would receive some sensible suggestions along the line of new things to make. They would be less apt, too, to involve departure from the fields in which you are present working.

Suggestions from within the organization are often dismissed with but little consideration. Imagine, then, how these men feel when some total stranger comes

in to occupy a "soft job," free from the routine discipline of the institution. Can you blame the men for saying to each other, "What's the use?"

If an outside inventor does not want a position of any kind with the company, there are four common methods of compensation. These are: stock in the company, guaranteed minimum royalty, straight percentage royalty, and outright cash payment. The first two methods are not usually satisfactory; the last two usually are.

Obviously, the reason why a man asks for stock in the company in payment for an invention is so that he may receive from year to year a share in the profits which his product brings to the manufacturer. That is nothing more than a fair desire, and consequently a commendable one.

Usually, however, the same result can be accomplished to the satisfaction of the inventor without "taking him into the family." When you issue stock in your company to a man, you are making him one of you, giving him a definite voice in the affairs of the corporation. He may not be able to take part in your directors' meetings. He may not be able to cast many votes at your stockholders' meetings. But he at least has a right to be there, and he has a right to speak and to be heard. It is possible that on some very important question, his particular votes might be a deciding factor. These men do not ordinarily have the knowledge of corporate procedure, business management, and finance that will make them intelligent and active corporation members.

### Taking a Chance

A guaranteed minimum royalty would be all right for the inventor, if there were only some means of guaranteeing sales to the manufacturer. There is nothing guaranteed in this world of business, however, unless it be an element of speculation in everything one does. So why should you, as a manufacturer, who is making the entire investment, and taking the entire risk of loss, guarantee anything to someone who is not putting up a single penny in cash to help push the thing through successfully?

The best answer to the suggestion of a guaranteed minimum royalty is this, "If you were going to make this product yourself, if you had never come to us, you would have to invest thousands of dollars of good hard money in order to put your product on the market. You would stand the risk of losing every cent that you had put in. You would not be able to make any profit for the first year or two, and even then the first profits would have to remain in the business to take care of natural expansion. And yet if you have the right faith in your own invention you would be willing to stake every bit of capital you possess, if necessary, in order to make a success of your venture.

"We have that same kind of faith in you and in your proposition. We believe we can make money with it; and we want you to share it with us. We are willing to put up all the money. We will assume all the risk. Is it fair, under such circumstances, to ask that we guarantee you a profit, even before we know whether your product will sell?"

An instance has come recently to the writers' attention in which a man invented a piece of tire repair equipment. He turned his patents over to a manufacturer for them to build and to sell the machines. The contract called for a royalty of 3½ per cent of the jobbers' net cost of the equipment sold, with a guaranteed minimum royalty of $2,000 a year. This means that the sales of this device would have to be about $60,000 a year to provide for the minimum royalty alone, on the percentage basis.

In the meantime, tires became very cheap in price, and tire repairing fell off sharply in volume. The equipment could not be sold. The books of the company showed a loss of about $20,000 in two years on this product, and its actual sales were less than that same figure.

The minimum royalty was paid for two years, and then the manufacturer, seeing that he had subscribed to a bad bargain, asked to be released from his contract. The agreement had been drawn by a competent corporation attorney and had been signed for the company by both the president and secretary. It was discovered, however, that the minimum royalty was guaranteed for the life of the patent, and not a single word had been included concerning cancellation. The affair is now involved in a mess of litigation which, it seems, will be decided in favor of the inventor.

### Royalty vs. Outright Purchase

The only difference between straight royalty and an outright cash payment from the standpoint of the manufacturer, is this: If you think the product is going to be a profitable one to make and sell, you had better pay a few thousand dollars outright, and be under no further obligation to the inventor. On the other hand, if there is some doubt about whether it will sell readily, you will do better to offer a royalty on every unit sale and thus hold down your payments during the period when the venture is most speculative.

Quite often it is difficult for inventor and manufacturer to agree on the amount of royalty to be paid. The inventor has a poor conception of manufacturing costs, overhead expenses, and sales and advertising requirements, and it will be his tendency to want to burden the product with a royalty that hampers its sale. Looking back upon these suggestions, we would say that they may all be boiled down into this single sentence. Don't take the outside inventor into your organization unless there is a definite need for him, and don't make his remuneration any greater than it would be if he were to make the investment and assume the risk of doing the manufacturing himself.

One company, which took on a new product recently, found itself offered the manufacture and sale of such things as lawn mowers, cultivators, saw filing machines, meat slicers, special valves for steam engines, bicycle wheels, winter heaters for automobiles, gasoline stoves for campers, and gasoline pumps for filing stations. Every inventor thought he had a world beater, yet each was turned down. Perhaps someone else is learning whether some of these things really are world beaters or not.

Usually one can spend a hundred dollars in prior investigation, which may save thousands of dollars of foolish expenditure later on. Don't laugh at the gasoline pump manufacturers who will have to close down when your improved pump gets onto the market. Remember that one of them recently sold his millionth pump, so there must be some merit in his product. Go to the oil companies and describe the pump you are considering. If none of them will buy your pumps, the time to find that out is before you begin to make them and not after you have invested in equipment.

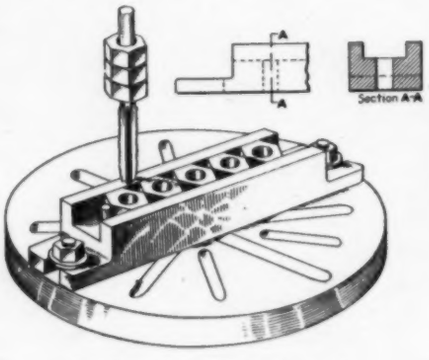
# Ideas from Practical Men

**The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit**

## Nut-Tapping Fixture for the Drill Press

BY H. L. WHEELER

Tapping nuts in the drill press may be speedily done by the use of the simple and inexpensive fixture illustrated. A regular nut tap having a long shank is used. The fixture is made from cold-rolled or machinery steel and is provided with a clearance hole for the tap, and a stop pin. It is attached to the drill-press table.




*Fixture for tapping nuts*

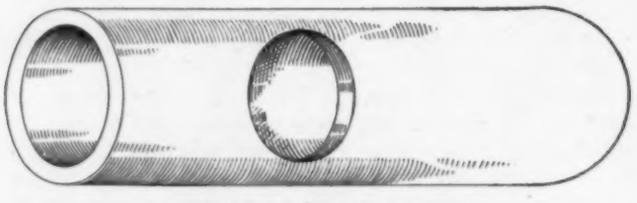
In use, the groove is kept filled with nuts from a box near by the operator. The operator feeds the tap with one hand and as fast as the nuts pass over the thread he pushes another in place against the stop pin.

Where a great variety of sizes of nuts are to be tapped, it will pay to have a fixture to accommodate each size.

## How Would You Do This Job?

BY HENRY DENSMORE

Since the *American Machinist* is propounding problems to be solved by its readers, with a bonus offered for the most practical solution, I am encouraged to offer one of my own, though under a somewhat different set of conditions. The conditions are as follows: The



*The job to be done*

number of pieces to be done is virtually unlimited—hundreds of thousands, with good prospect of millions—so that tool cost is not a factor. There is no reward other than the satisfaction born of the knowledge of a good job well done, and anybody may compete—even editors of the *American Machinist*.

The job is illustrated by the sketch herewith. Given a drawn-steel shell two or more inches long with one end closed, and having an internal diameter of $\frac{7}{8}$ in. and a wall thickness of 0.087 in., how would you make a hole through the side wall to intersect the axis at a right angle, the cross-hole to have a diameter but $\frac{1}{32}$ in. less than the internal diameter of the shell?

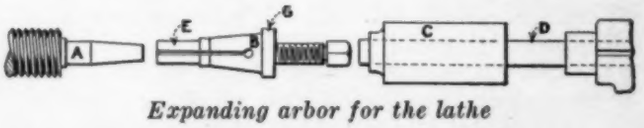
I am not asking for information—I know. I have seen the job in progress. The tools are so inexpensive that they would pay for themselves on a job of one hundred pieces in time saved over any other method I have seen or could devise, and it is so simple as to make the average toolmaker mad that he did not at once invent the method himself. At least that is the way it affected me at the time I saw the work being done.

## An Expanding Arbor

BY C. D. MICHENER

The illustration shows an expanding arbor that we have found quite useful for some kinds of work.

The shank *A* is made to fit the lathe spindle and has a taper of $\frac{5}{8}$ in. per ft. on the outboard end. The expansion bushing *B* is taper reamed at one end to fit




*Expanding arbor for the lathe*

the taper on the shank *A*, while the other end is tapped and provided with a long setscrew, as shown.

The part *C*, used as a hammer for expanding the bushing, is provided with a soft nose, and slides on the bar *D*, which fits in the tail spindle.

In operation, the work to be turned is placed on the expansion bushing *B*, at *E*, which is then entered on the taper end of the shank *A*. The bushing is expanded by sliding the hammer C quickly along the bar *D*, the blow being received by the enlarged end of the bushing at *G*. The hole in the hammer is larger than the head of the setscrew in the expanding bushing.

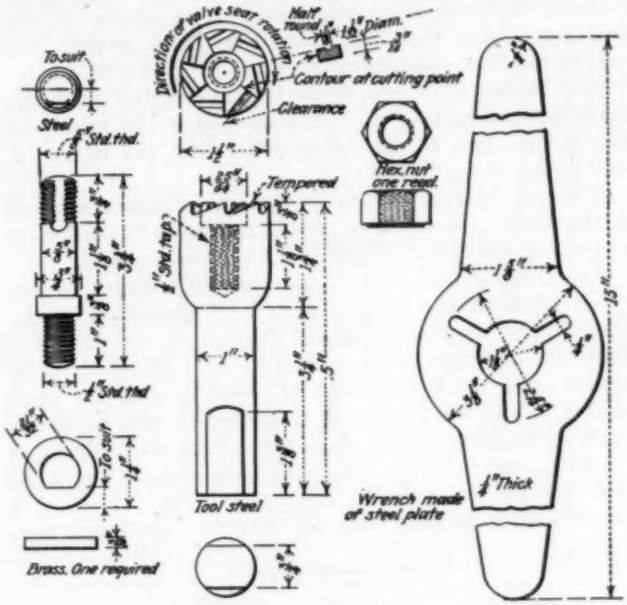
For removing the bushing, the long setscrew is screwed in until it abuts the end of the shank, thus forcing off the bushing, which latter will contract and free the work. The screw is operated while the lathe is in motion, by means of a wrench pivoted to the toolblock.

# IDEAS FROM PRACTICAL MEN

## A Useful Tool for Repairing Triple-Valves

By Louis Reibel

The accompanying drawing shows a tool that is very useful for repairing the triple-valves that are a vital part of the air-brake equipment of railroad cars and locomotives. Without a device of this nature it is necessary to take out the emergency-valve seat—which is in a brass disk—and spend quite a bit of time truing it up in a lathe.




*Tool for reseating triple valves*

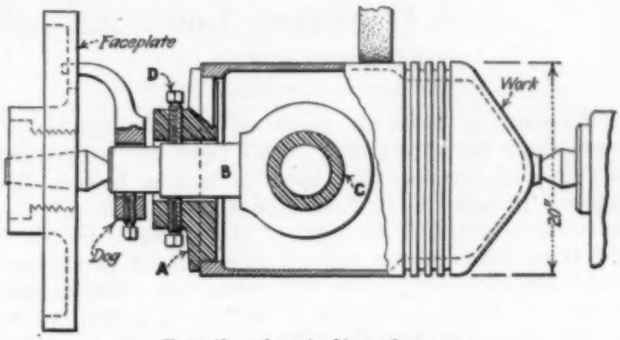
The device is very simple. The seating tool has two flat sides so that it may be gripped in a bench vise in an upright position and the disk of the valve-seat inverted over the stud; being held down and fed to the cutter by tightening the nut as the disk is revolved by means of the sheet-steel wrench, the slots in which fit over the lugs on the bottom of the disk.

## Centering Fixture for Grinding Large Pistons

By Frank Waldo

Although large sized pistons, such as used on Diesel oil engines, are similar in construction to those used for automotive work, the method of handling is somewhat different, requiring special tooling equipment. The problem of grinding the outside diameter of a 20-in. piston to insure the wristpin bore being in true relation with the centerline of the work was solved by means of the device shown in the illustration.

To compensate for any inaccuracies that might exist between the bore of the open end and the outside diameter, an adjustable fixture, comprising a centering plug *A* and a mandrel *B*, is used. The mandrel is inserted in the open end of the piston and held in place by a wristpin *C* that is an actual component, having one end slightly tapered to form a snug fit so there is no side or end play. The centering plug then is




*Details of grinding fixture*

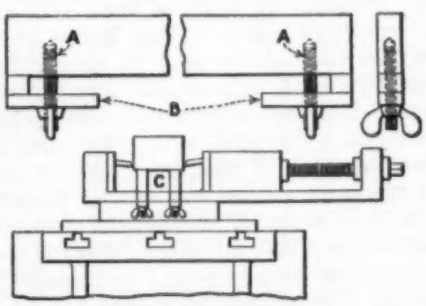
assembled on the mandrel and into the bore of the work. The clearance between the mandrel and the plug is $\frac{1}{32}$ in. The work is placed in the grinding machine between centers as shown. A dial indicator is used to check the concentricity of the outside diameter to ascertain if the surface will clean up in accordance to the amount of stock to be removed. Four adjusting screws *D*, located in the plug, are used to shift the work in the direction required after which they are tightened in the desired position.

The use of the wristpin offers a means of aligning the work so that slight shifting of the piston up or down will not cause serious mis-alignment at assembly. A similar fixture is used for a variety of pistons ranging from 12 to 24 in. in diameter.

## Adjustable Parallels—Discussion

By Charles Kugler

The article by W. E. Buck, under the title given above, and published on page 322, Vol. 63, of the *American Machinist*, reminds me how I get the same results by a cheaper and quicker method. I have never seen a shaper in which the table did not sag more or less, which means that to do accurate work, the work must be packed up in front to bring it parallel with the travel of the ram.




*Parallels to compensate for sag of shaper table*

My method is to take two pieces of cold-rolled steel, about 12x½x½ in., and drill and tap them for ¼-in. thumb screws as shown at *A*. Two short pieces, as at *B*, serve as clamps to hold the cold-rolled pieces to the shaper vise in the manner indicated at *C*. After they have been clamped in place, a cut is taken over them, bringing the tops parallel with the travel of the ram.

For holding the work down on the cold-rolled pieces, I use the conventional "hold downs," as shown in the illustration.

# IDEAS FROM PRACTICAL MEN

## A Trepanning Tool

By William Mason
Liverpool, England

For cutting holes in plates having a diameter of more than, say, 3 in., such as the holes for water-tube boilers and the stay-tube holes in marine boilers, the general practice is to first drill a small hole for the purpose of guiding the pilot of the cutter head while the large hole is being cut out, thus making two operations for each hole. The apparatus described in this article, of which a drawing in section is given, makes it unnecessary to drill the pilot hole, and thus the large hole is cut out at one operation, resulting in considerable saving of time.

The spindle of the device *A*, Fig. 1, has a square right-hand thread, *B*, cut upon it. and carries the hardened center *C* at the lower end. Mounted on the spindle is the bifurcated frame *D*, terminating in a handle at *E*, and held together at the other end by the stud *G*. Between the parts of the frame are two gears and a compound pinion. Gear *H* has 24 teeth and gear *I* has 23 teeth. The pitch of gear *I* is slightly greater than the pitch of gear *H*. The pinion *K* has 18 teeth, and is provided with a boss upon which is shrunk the pinion *L*. The pitch of *L* is the same as that of gear *I*, but the sum of the diameters of their pitch circles is the same as the sum of the diameters of the pitch circles of *K* and *H*, so that the teeth of each pair mesh accurately with each other. Gear *H* is keyed on spindle *A*, and the hole in gear *I* is threaded to fit the thread at *B*. The compound pinion *K-L* is mounted on the eccentric shaft *M*, upon which it is free to revolve. When the eccentric shaft is fixed by pin *N* in the position shown, the compound pinion *K-L* is in mesh with gears *H* and *I*, and thus *H* drives *I* through *K-L*, *I* rotating at a higher speed than *H*, causing *I* to run down on the thread of spindle *A*. Gear *H* has 24 teeth, and when it has made 23 revolutions, gear *I*, having 23 teeth, will have made 24 revolutions and will have descended $\frac{1}{3}$ in., the pitch of the screw *B* being three threads per inch, and thus the cutting tool *O* will have cut into the plate *P*, $\frac{1}{3}$ in., making the cutting feed nearly 0.014 in. per revolution. When the tool *O* has cut through the plate, the shaft *M* is rotated half a revolution, withdrawing the pinion out of mesh with the gears. The cutting tool *O* then ceases to revolve and is automatically lifted out of the hole in the plate as the screw *B* continues to revolve, the friction between the cutting tool *O* and the hole being sufficient to prevent the tool from revolving. The rising of the tool forces the disk cut from the plate, against the center *O*, thus ejecting it.

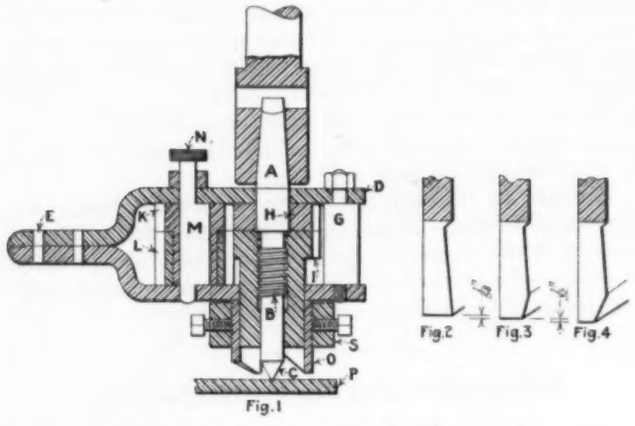



*Fig. 1—Details of the trepanning tool. Figs. 2, 3 and 4—The three cutting tools*

The frame *D* is prevented from revolving with the machine spindle by a stop bar secured to the saddle on the radial arm, in such a position that the handle *E* will strike it.

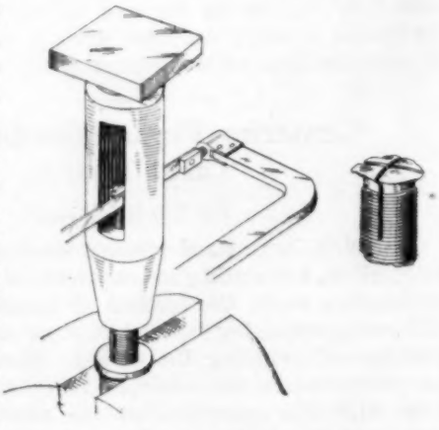
Since all feeding is done by the mechanism contained in the device, the machine feed is not used, but is locked to prevent the spindle from being pushed upward.

The cutting tool *O* is in the form of a bush, having three teeth at the bottom end, with clearance in the inside only, as illustrated in Figs. 2, 3 and 4. The bush is cut through on one side, so that when it is placed upon the turned boss of wheel *I*, with the band *S* over it and the setscrews tightened, it will be firmly fixed. The tool in Fig. 4, is beveled on one side to $\frac{3}{16}$ in. wide, and is $\frac{1}{32}$ in. lower than the one in Fig. 2, so that the cut is divided, the tool in Fig. 2 cutting a groove $\frac{3}{32}$ in. wide, thus reducing the strain upon each tool.

## How to Remove a Battered Toolpost Screw

By H. L. Wheeler

Toolpost screws on lathes sometimes become upset on the end from hard usage, or because they may be too soft. Continued use in this condition makes them worse, and finally it is almost impossible to move the screw up or down. Because screws in this condition cannot readily be screwed out of the holes for replacing by new screws, is probably one reason why they are neglected so long.



*Removing an upset screw*

It is, however, a simple matter to remove an upset screw, as shown in the accompanying illustration. Grip the head of the screw in a vise and saw two longitudinal slots at right angles with each other about an inch deep. The four sections left by the saw cuts can now easily be broken away with a chisel, when the scrw can readily be taken out. To saw the slots, insert the blade of the hacksaw through the hole in the toolpost, and turn the handle at right angles to the blade.

Punch here to suit your binder

# Sizes of Standard Milling Cutters (Simplified Practice)

## Inserted-Blade Cutters (Side and Face Mills)

[Inserted blade cutters are regularly furnished with high-speed steel blades. The side cutters have the blades set straight while the face cutters have the blades set at an angle. Face milling cutters have a taper hole and keyway and will be furnished either right or left hand. Inserted blade cutters with carbon-steel blades are special]

### Side-Milling Cutters

| Diameter in Inches | Width of Face | Size of Hole | Diameter in Inches | Width of Face | Size of Hole |
|---|---|---|---|---|---|
| 6 | 2 | 1¼ | 8 | 2 | 2 |
| 7 | 2 | 1¼ | 9 | 2 | 1½ |
| 7 | 2 | 1¾ | 10 | 2 | 1½ |
| 8 | 2 | 1½ | | | |

### Face-Milling Cutters

| Diameter | Cutting Face of Blades | | B. & S. Taper Hole | Diameter | Cutting Face of Blades | | B. & S. Taper Hole |
|---|---|---|---|---|---|---|---|
| | Width | Depth | | | Width | Depth | |
| 5½ | 2¼ | 1 1/16 | 10 | 7½ | 2¼ | 1 1/16 | 12 |
| 5½ | 2¼ | 1 1/16 | 12 | 8½ | 2¼ | 1 3/16 | 12 |
| 6½ | 2¼ | 1 1/16 | 10 | 9½ | 2¼ | 1 3/16 | 12 |
| 6½ | 2¼ | 1 1/16 | 12 | | | | |

## Shell End Mills

[Shell end mills are regularly furnished right or left hand and with spiral teeth. Mills with straight teeth are special]

| Diameter | Length of Cut | Size of Hole | Diameter | Length of Cut | Size of Hole |
|---|---|---|---|---|---|
| 1¼ | 1¼ | ½ | 2⅛ | 1¾ | ¾ |
| 1⅜ | 1¼ | ½ | 2¼ | 2¼ | 1 |
| 1½ | 1¼ | ½ | 2⅜ | 2¼ | 1 |
| 1⅝ | 1¾ | ¾ | 2½ | 2¼ | 1 |
| 1¾ | 1¾ | ¾ | 2¾ | 2¼ | 1 |
| 1⅞ | 1¾ | ¾ | 3 | 2¼ | 1 |
| 2 | 1¾ | ¾ | | | |

## Coarse-Tooth Shell End Mills

[Coarse-tooth shell end mills are regularly furnished of high-speed steel either right or left hand and with spiral teeth. Coarse-tooth shell end mills with straight teeth are special. Carbon-steel, coarse-tooth shell end mills are special]

| Diameter | Length of Cut | Size of Hole | Diameter | Length of Cut | Size of Hole |
|---|---|---|---|---|---|
| 1¼ | 1¼ | ½ | 2⅛ | 1¾ | ¾ |
| 1⅜ | 1¼ | ½ | 2¼ | 2¼ | 1 |
| 1½ | 1¼ | ½ | 2⅜ | 2¼ | 1 |
| 1⅝ | 1¾ | ¾ | 2½ | 2¼ | 1 |
| 1¾ | 1¾ | ¾ | 2¾ | 2¼ | 1 |
| 1⅞ | 1¾ | ¾ | 3 | 2¼ | 1 |
| 2 | 1¾ | ¾ | | | |

## Coarse-Tooth Shell End Mills for Cincinnati Milling Machines

[These shell end mills are regularly furnished in high-speed steel either right or left hand and with spiral teeth. Coarse-tooth shell end mills of carbon steel are special. Shell end mills with straight teeth are special]

| Diameter | Length of Cut | Size of Hole | Diameter | Length of Cut | Size of Hole |
|---|---|---|---|---|---|
| 1⅝ | 1⅛ | ¾ | 2½ | 1⅝ | 1¼ |
| 1¾ | 1⅛ | ¾ | 2¾ | 1⅝ | 1¼ |
| 1⅞ | 1⅛ | ¾ | 3 | 1⅝ | 1¼ |
| 2 | 1¼ | 1 | 3½ | 2 | 1½ |
| 2¼ | 1¼ | 1 | 4 | 2 | 1½ |

## Screw-Slotting Cutters

[Screw-slotting cutters are not ground on the sides]

| Thickness of Cutter, American Wire Gage | Thickness of Cutter in Decimals | Diameter of Cutter | Size of Hole | |
|---|---|---|---|---|
| | | | Carbon Steel | High-Speed Steel |
| 5 | 0.182 | 2¾ | 1 | .. |
| 6 | 0.162 | 2¾ | 1 | 1 |
| 7 | 0.144 | 2¾ | 1 | 1 |
| 8 | 0.128 | 2¾ | ¾, 1 | 1 |
| 9 | 0.114 | 2¾ | ¾, 1 | 1 |
| 10 | 0.102 | 2¾ | ¾, 1 | 1 |
| 11 | 0.091 | 2¾ | ¾, 1 | 1 |
| 12 | 0.081 | 2¾ | ¾, 1 | 1 |
| 13 | 0.072 | 2¾ | ¾, 1 | 1 |
| 14 | 0.064 | 2¾ | ½, ⅝, ¾, 1 | 1 |
| 15 | 0.057 | 2¾ | ½, ⅝, ¾, 1 | 1 |
| 16 | 0.051 | 2¾ | ½, ⅝, ¾, 1 | 1 |
| 17 | 0.045 | 2¾ | ½, ⅝, ¾, 1 | 1 |
| 18 | 0.040 | 2¾ | ½, ⅝, ¾, 1 | 1 |
| 19 | 0.035 | 2¾ | ½, ⅝, ¾, 1 | 1 |
| 20 | 0.032 | 2¾ | ½, ⅝, ¾, 1 | 1 |
| 21 | 0.028 | 2¾ | ½, ⅝, ¾, 1 | 1 |
| 22 | 0.025 | 2¾ | ½, ⅝, ¾, 1 | 1 |
| 23 | 0.023 | 2¾ | ½, ⅝, ¾, 1 | 1 |
| 24 | 0.020 | 2¾ | ½, ⅝, ¾, 1 | 1 |
| 25 | 0.018 | 2¾ | ½, ⅝, ¾, 1 | .. |
| 26 | 0.016 | 2¾ | ¾, 1 | .. |
| 27 | 0.014 | 2¾ | ¾, 1 | .. |
| 28 | 0.012 | 2¾ | ¾, 1 | .. |
| 30 | 0.010 | 2¾ | ¾, 1 | .. |
| 32 | 0.008 | 2¾ | ¾, 1 | .. |
| 34 | 0.006 | 2¾ | ¾, 1 | .. |
| 10 | 0.102 | 2¼ | ⅝ | .. |
| 11 | 0.091 | 2¼ | ⅝ | .. |
| 12 | 0.081 | 2¼ | ⅝ | .. |
| 13 | 0.072 | 2¼ | ⅝ | .. |

| Thickness of Cutter, American Wire Gage | Thickness of Cutter in Decimals | Diameter of Cutter | Size of Hole | Thickness of Cutter American Wire Gage | Thickness of Cutter in Decimals | Diameter of Cutter | Size of Hole |
|---|---|---|---|---|---|---|---|
| 14 | 0.064 | 2¼ | ⅝ | 14 | 0.064 | 1¾ | ⅝ |
| 15 | 0.057 | 2¼ | ⅝ | 15 | 0.057 | 1¾ | ⅝ |
| 16 | 0.051 | 2¼ | ⅝ | 16 | 0.051 | 1¾ | ⅝ |
| 17 | 0.045 | 2¼ | ⅝ | 17 | 0.045 | 1¾ | ⅝ |
| 18 | 0.040 | 2¼ | ⅝ | 18 | 0.040 | 1¾ | ⅝ |
| 19 | 0.035 | 2¼ | ⅝ | 19 | 0.035 | 1¾ | ⅝ |
| 20 | 0.032 | 2¼ | ⅝ | 20 | 0.032 | 1¾ | ⅝ |
| 21 | 0.028 | 2¼ | ⅝ | 21 | 0.028 | 1¾ | ⅝ |
| 22 | 0.025 | 2¼ | ⅝ | 22 | 0.025 | 1¾ | ⅝ |
| 23 | 0.023 | 2¼ | ⅝ | 23 | 0.023 | 1¾ | ⅝ |
| 24 | 0.020 | 2¼ | ⅝ | 24 | 0.020 | 1¾ | ½, ⅝ |
| 25 | 0.018 | 2¼ | ⅝ | 25 | 0.018 | 1¾ | ½, ⅝ |
| 26 | 0.016 | 2¼ | ⅝ | 26 | 0.016 | 1¾ | ½, ⅝ |
| 27 | 0.014 | 2¼ | ⅝ | 27 | 0.014 | 1¾ | ½, ⅝ |
| 28 | 0.012 | 2¼ | ⅝ | 28 | 0.012 | 1¾ | ½, ⅝ |
| 30 | 0.010 | 2¼ | ⅝ | 30 | 0.010 | 1¾ | ½, ⅝ |
| 32 | 0.008 | 2¼ | ⅝ | 32 | 0.008 | 1¾ | ½, ⅝ |
| 34 | 0.006 | 2¼ | ⅝ | 34 | 0.006 | 1¾ | ½, ⅝ |

## Coarse-Tooth Shell End Mills With Threaded Hole

[These shell end mills are regularly furnished in high-speed steel either right or left hand and with spiral teeth. Coarse-tooth shell end mills of carbon steel are special. Shell end mills with straight teeth are special]

| Diameter | Length of Cut | Size of Hole | | Diameter | Length of Cut | Size of Hole | |
|---|---|---|---|---|---|---|---|
| 2½ | 1¼ | 1 | 10 | 3½ | 2 | 1½ | 8 |
| 3 | 1¾ | 1¼ | 8 | 4 | 2 | 1½ | 8 |

*(To be continued)*

Punch here to suit your binder

Trim Line


© American Machinist

# Practical Shop Problems

***Questions of a Practical Nature will be answered in these columns***

## Determining the Polarity of the Work in an Arc-Welding Circuit

*Q. We are interested in the question asked and your answer on page 866, Vol. 63, of the "American Machinist, concerning the correct side of the arc to place the work for arc welding. Please tell us how we can determine which is the positive side of this arc.*

A. There are a number of ways of determining the polarity of the electric circuit. Connecting a volt meter in the line is perhaps the simplest, the needle pointing in the direction in which the current is assumed to flow, from positive to negative. If it is located between the generator and the electrode and points toward the latter, the electrode is negative and the work will be positive.

The determination can be made without the volt meter by drawing an arc on a welding job and observing its characteristics. If the work is positive and the electrode is negative, the arc will be fairly stable. If the work happens to be the negative side, the electrode will heat up rapidly and the arc will no longer be steady and will be difficult to maintain.

With reversed polarity, the work negative, the penetration at the weld will be shallow and the deposited metal can be rather easily broken loose.

## Tapping Brass

*Q. We have an operation in our regular production that involves tapping a tough brass with a $\frac{5}{8}$-in., 11 U.S.S. plug tap. Our experience has been most unsatisfactory. The best we can do is to tap 40 holes, with a high-speed tap at that, and then the clearance on the tap is completely worn off and the tap is scrap. We are tapping these holes dry.*

*If you can give us any suggestions to enable us to get more out of our taps we shall be indebted to you.*

A. Brass, being a soft material, will have a decided tendency to compress as the threads are cut and will make a thread, when the theoretical size of tap drill has been used, that will jam in against the tap. The proper size of drill to use is one that will theoretically result in not more than a $\frac{3}{4}$ full thread when the tap is run in. This may be a part of your trouble.

It is proper to grind a tap that is to be used in brass so that its flutes will present a backward rake angle of approximately 4 deg. between the line tangent to the diameter of the thread and the face of the flute. This negative angle keeps the brass from being forced against the metal of the face of the cutting threads.

Manufacturers of taps and drills recommend, for cutting brass, the use of a flood of an oil like kerosene and if the work cannot be continuously flooded none should be used. The general consensus seems to be to run the tap dry.

There is a general misunderstanding with regard to the use of high-speed and carbon steel that may also represent part of your trouble.

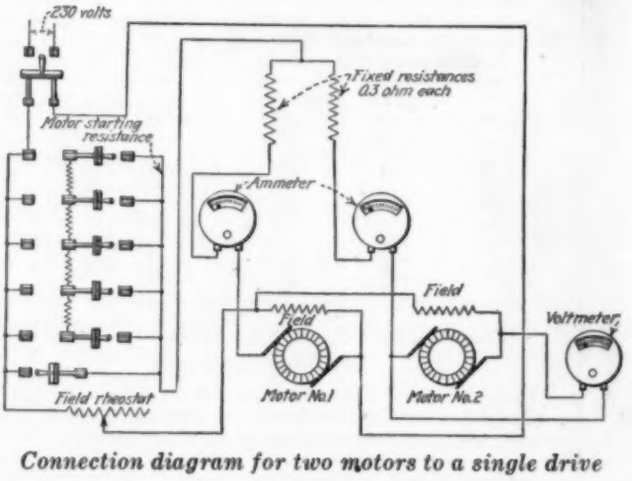
High-speed steel will retain a cutting edge while working continuously at higher temperatures than carbon steel can be expected to stand. It will however lose its keen cutting edge sooner than will carbon steel. Since the tap will have no opportunity to heat up to the point at which it pays to use high-speed steel in your operation, and since it will not retain the sharp edge, we suggest that you use a good grade of carbon tap.

Finally, in the event that you are not aware of the fact, we want to tell you that there is a service, waiting for your requests for assistance from the tap manufacturers, that is maintained to solve just such troubles as you are having. We suggest that you write for your share of this service direct.

## Two Motors Connected to a Common Drive

*Q. We have an air compressor to set up that requires a 40-hp. motor. We have no motor of this size, and intend to use two of 20 hp. that we have available. We desire to connect them to a common pulley to drive the compressor, and want to know if such an arrangement will operate satisfactorily.*

A. It is entirely possible to arrange the two motors as you describe and run the compressor satisfactorily, but it is necessary to make a special electrical connection between the two, as shown on the accompanying sketch.




*Connection diagram for two motors to a single drive*

Resistances are inserted in series with the armatures of the two motors, which are shown as shunt wound machines. The motors are connected in multiple with a fixed resistance in each armature circuit. One field rheostat is used to control the field circuits of both. Even distribution of load can be obtained by shifting the brushes of one of the motors.

# Technical Abstracts

### Belting

The belting standardization system installed in the E. I. du Pont Co. and the General Motors Corporation by the author, William Stamiar, is discussed and he says that there is evidence of an awakening on the subject of belting and mechanical power transmission. Investigations have shown that many plants keep belt records but, regardless of the fact that the records show the superiority of one type over another, the same brand is continued in operation because the data obtained are not studied and used.

The belting standardization system is a method whereby each individual belt drive is scheduled in chart form, whether the belt in question is ½ in. or 30 in. wide. If the plant is divided into buildings, each building has its chart with subdivisions for the various floors and operations, and if into areas each area has its schedule with subdivisions. Each subdivision in the schedule is again sub-divided into four columns; location, type and size, present belt, belt recommended and fastener recommended.

In testing belts, tests need not necessarily be run until the belt has actually gone to shreds, because it is possible to obtain comparative results on one type over another in two or three months' time and in some cases in even shorter time.—*Industrial Management*, Nov. 1925, p. 272.

---

### The Small Manufacturing Business

Manufacturers are just beginning to recognize the great importance of factory layout, arranging the shop equipment so that the flow of parts will be in a line as far as possible. C. U. Carpenter, the author of this article, points out that each product should be placed in one of two divisions, group A to contain all the parts that are difficult to manufacture or that have a large number of operations and group B to contain the balance of the parts. Try to group manufacturing tools so that these two groups may be separated even though a few more machine tools are required to do it. Then study intensively the difficult parts one by one. Using desired output and the length of time required in the shop for production as a basis, schedule the starting of the orders and the arrival in the finished stock room, then organize a force so that this schedule will be maintained.

Assembling should be studied just as intensively. Ordinarily assembling costs more than machining. The layout and planning of this department is all important and should receive the attention of the best brains possible.—*Management and Administration*, Oct., 1925, p. 195.

---

### Annealing

This paper, by H. B. Knowlton, discusses the definition and process of annealing. True annealing consists in heating the steel to just above the critical point for a long enough time to completely dissolve all but the excess cementite, followed by slow cooling. The slower the cooling through the temperatures just below the critical point, the softer the steel will become. The structure is an important factor in the machineability of steel. The slower the cooling, the greater will be the tendency to produce the spheroidized condition. The softest and most completely spheroidized steel may not machine the best. A mixture of laminated pearlite and spheroidized cementite is preferred. When steel has a cementite network structure due to overheating it should be normalized by heating to above the point where all of the cementite may be dissolved in the austenite, followed by as rapid cooling as possible. It should be further annealed after this treatment. The presence of the network structure produces poor machining and brittleness after hardening. The loneal consists in heating to just below the critical point, followed by any rate of cooling. This treatment will soften the steel and relieve strains to some extent, but not as thoroughly as full annealing. It will not break up the network structure. The microscope is a useful instrument in testing the efficiency of annealing. In many shops this type of inspection is not available. In such case it is best to depend upon accurate control of the annealing process rather than an inspection.—*Transaction of American Society for Steel Treating*, Oct., 1925, p. 484.

---

### Salt Baths

For certain precise heat-treating operations, open-fire heating methods are not entirely satisfactory. The heats are uneven, dies are distorted, skilled workmen are required and results are unreliable. Lead hardening is an improvement but not as successful as salt baths. The specific gravity of the salt bath is one-sixth that of lead and results in a longer pot life. The salt bath is neutral to the metals treated and for this reason there is no scaling, or other deleterious surface effects. Tools may be machined to finished size before treatment, thereby reducing to a minimum or eliminating the grinding allowance.

The work to be hardened is first preheated by means of the waste flue gases and is then immersed in the salt bath. The length of time a piece is left in the bath depends, of course, on its shape and weight. Upon removal of the work from the bath, a thin film of salt adheres, thus protecting the piece from scaling. The piece is then quenched in oil or other mediums and later drawn in a bath of tempering salts. For the average run of tool and die work, a consumption of about ½ lb. of salt per 100 lb. steel is required.

A high-speed-steel furnace should have at least three pots, the center one being the high-heat pot and maintained at a temperature of about 2,300 deg. F. One of the side pots is used for preheating the work to 1,600 deg. F. and the other side pot is used for quenching at about 1,100 or 1,200 deg. F. In a properly designed unit waste heat from the center pot is used for preheating the two side pots.—*Iron Trade Review*, Nov. 5, p. 1148.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

## *The President Stresses Service*

THE law of service is the only sound and safe foundation for the business structure. In his address to the New York State Chamber of Commerce a few nights ago President Coolidge dwelt on this point and went on to say that the Government is doing its best to aid business that is based on service.

Mr. Coolidge's high opinion of the way business is generally conducted in this country should be encouraging to the conscientious business man who sometimes wonders if competition in his particular line is as fair and above-board as it should be. Perhaps his too close contact with the petty details has blinded him to the significance of the really great strides that have been made in the last few years by business as a whole. The President is not hampered by details and can therefore comprehend the position of general business much more clearly. His opinion confirms the belief of business leaders that codes of ethics are more than mere high sounding phrases.

Another pronouncement encouraging to business men is the President's emphatic statement that government's task is to provide security for private enterprise, and to restrict regulatory measures to the irreducible minimum consistent with the public welfare. In view of the more or less pernicious activities of certain bureaucrats this enunciation of policy by the head of our Government is reassuring.

As business has realized the advantage of conducting itself so that regulation is not needed the administrative departments have been freed to turn their efforts to constructive rather than destructive channels and business has profited accordingly. The work of the Department of Commerce under the able direction of Secretary Hoover was mentioned by the President as an outstanding example of constructive activity.

Although elimination of waste originated with Mr. Hoover as a working slogan it has been seized eagerly by business and industry quite generally and the returns have been astounding. Coupled with the Government's policy of rigid economy it has done much to bring about the present widespread prosperity.

According to Mr. Coolidge, "We have grown exceedingly great in population and in riches. This power and this prosperity we can continue for ourselves if we will but proceed with moderation."

## *Power as an Index of Progress*

ACCORDING to a number of economists the use of power is a sure index of the advance of civilization. This is particularly true of the machine building industry where, in spite of friction-reducing bearings, the power used per man and per machine has increased in an almost unbelievable manner.

There is perhaps no more striking example of this increase in power than in the development of grinding machinery, although all types of machines show the same general trend. Early grinding machines were driven by a small belt, and they were practically polishing machines that removed very little metal. Modern grinding machines on the other hand not only remove metal in appreciable quantities but compete with milling machines, planers and lathes on both roughing and finishing cuts in production work.

This comparison of the increased power used by machines can be strikingly illustrated. Forty years ago it was not uncommon to find good sized machine shops for those days, being run by a 25-hp. steam engine.

When we think of a whole shop being run by a 25-hp. engine, it is startling to realize that it is not uncommon now to find a 100-hp. motor on a single machine. When this machine happens to be a grinder the change can be appreciated to the full. Power is certainly an indication of progress.

## *Keep the Wheels Moving*

IN ANY large manufacturing plant, the main question to be considered is continuity of production. The cost of machine breakdowns, of accidents and of other interruptions, while they may be expensive in themselves, do not as a rule equal the loss due to delay in production. For there are so many angles to be considered that the total cost is not always apparent. It frequently happens that such a comparatively insignificant accident as the breaking of a counterweight cable will cause far more loss from interference with production than the cost of the repair itself.

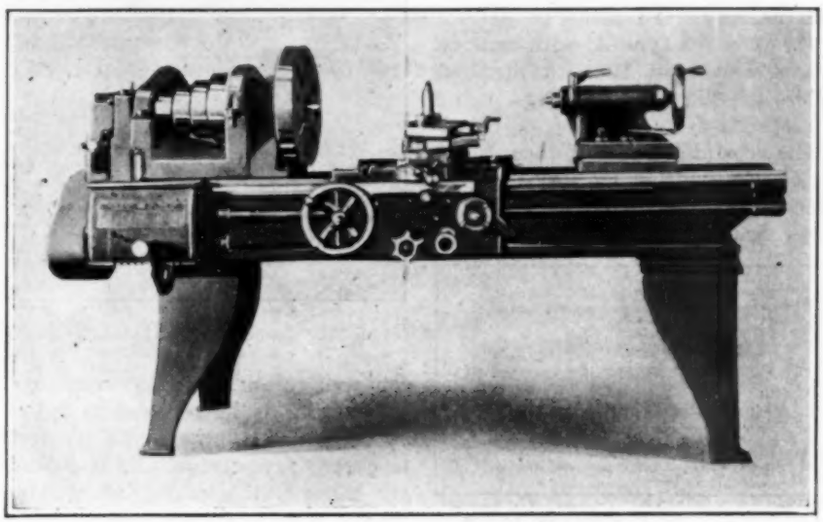
In the same way the expense of accidents in shops frequently shows up more in the increased cost of production than in the compensation paid the worker. If one link in the chain of a production line is disabled, the whole line slows down if it does not stop. Nor does the trouble stop there, it reaches to the assembly division and even to the sales.

There are plants in which the work of accident prevention is conducted on a basis of its effect on production. And while this may, at first glance, seem to overlook the human element, it is well to bear this angle in mind at all times.

# Shop Equipment News

## South Bend Quick-Change Gear Lathes

The South Bend Lathe Co., 337 East Madison St., South Bend, Ind., has brought out a line of quick-change gear lathes including many additional improvements and features to its former line described on page 915, Vol. 37 of the *American Machinist*. The lathes are intended for toolmaking where accuracy is required and for general manufacturing purposes. The construction includes an increase in weight throughout and accuracy in the various units with a view of making them interchangeable.



*South Bend Quick-Change Lathe*

The bed comprises a semi-steel casting, braced by cross-girts at short intervals over its entire length. Outside V-ways are provided for the saddle bearings while inside V-ways are used for the headstock and tailstock. The headstock is of reinforced construction to insure rigidity. Eight spindle speeds are provided, four being direct drive and four by the use of the back gears. Improved gear guards completely inclose all operating gears.

The tailstock, mounted on the bed with a long bearing surface, is offset to allow the compound rest to swivel completely around. It is provided also with a set-over for paper turning.

The carriage has a long bearing surface on the bed to reduce wear. Oil pads for oiling and cleaning the ways of the bed are used. T-slots are machined in the saddle for the clamping of large work and special fixtures. A locking device is arranged on the carriage so that it can be locked to the bed when the automatic cross-feed is in operation. A safety device in the carriage prevents the half-nut from engaging the lead screw while either the automatic cross or longitudinal feed is in action. A wick-oiling system is used for lubricating the apron.

The compound rest is graduated to 180 deg. and can be swung around in any direction and clamped at will, giving any angle on the horizontal plane. The compound feed screw and the cross-feed screw are provided with micrometer graduation tellers that are marked in thousandths of an inch.

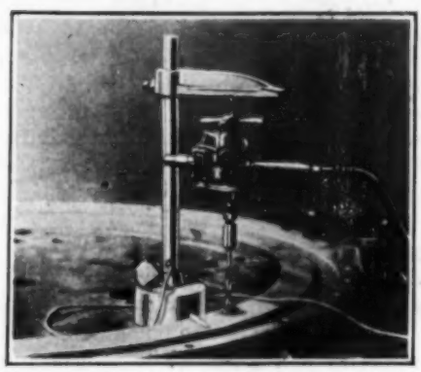
The quick-change gear box offers 48 speeds for screw cutting, ranging from 2 to 112 threads per inch. A variety of coarse and fine feeds is also provided. Feeds are available without changing of gears, all changes being obtained by two levers and a sliding knob located on the gear box. All the change gears are cut from solid steel, tested blanks.

The line of lathes includes sizes ranging from 9 to 24 in. swing, made in various lengths. The equipment furnished with the machine includes countershafts, face plates, a chuck adapter, centers, steadyrests, follow rests and wrenchs. The lathes also may be equipped with an individual motor drive that is to be mounted above the headstock.

## "American" Magnetic Tool Support

The magnetic tool support or "old man" illustrated, is manufactured by the American Hoist & Derrick Co., St. Paul, Minn. It can be used for backing up hand electric or pneumatic drills and other tools that require support and is intended to save the time used in clamping or finding a place to clamp a mechanically-secured support.

The work can be set on a metallic surface capable of magnetization or, if the work has sufficient surface and is itself of iron or steel, the holder can be placed directly upon it.



*"American" Magnetic Tool Support*

A switch and length of armored cable are attached to the base, the latter forming the magnet. The cord can be attached to a convenient source of current. The holder exerts sufficient backing-up power to serve for all ordinary work. The arm can be adjusted to suit the work in hand by loosening a setscrew and moving the arm on the column in the desired direction.

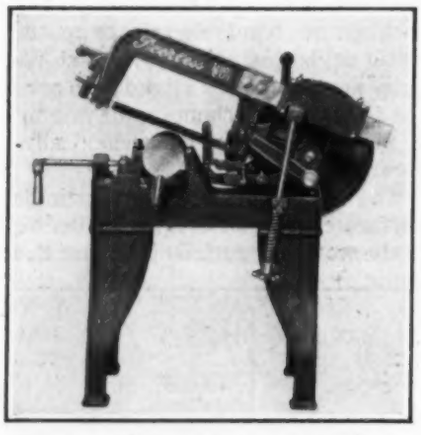
# SHOP EQUIPMENT NEWS

## Peerless Power Sawing Machine, Dry-Cut 4½x4½-Inch

The dry-cut, power, metal-sawing machine, illustrated, has been brought out by the Peerless Machine Co., Racine, Wis., for maintenance and general-purpose work where a heavier type of machine is not necessary.

Many of the principles of construction of the other types of Peerless sawing machines have been included in this model, including the lift of the blade on the non-cutting stroke; the spring-controlled, adjustable feed pressure; the automatic stop when the cut is completed and the advantage of having the saw frame stay at any position in which it is placed while setting the stock.

The machine is run at a comparatively low speed since it is a dry-cut



*Peerless Power Sawing Machine, Dry-Cut, 4½x4½-Inch*

machine. However, it can be operated at 100 strokes per min. when cutting low-carbon stock.

The capacity of the machine is for material 4½x4½ in. The length of stroke is 4½ in. It will take a saw blade 10 in. long. The machine is designed for a ½-hp., 1,750-r.p.m. motor. The height from floor to vise is 20 in. and the floor space required is 16x30 in. The weight is 165 lb. net.

## Vervoort Roller Bearings

The Vervoort Roller Bearing Co., Jamestown, N. Y., is manufacturing a line of rollers in the design of which balls are also incorporated to relieve the end friction of the rolls.

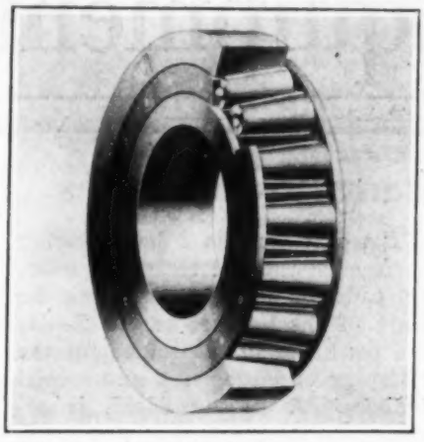


*Fig. 1—Vervoort Roller Bearing, Type-A*

The bearings are made in several types of which type A, with tapered rollers and type L, with straight rollers are illustrated in Figs. 1 and 2, respectively.

The retaining rings of these bearings are connected by stay-rods between the rollers. Grooves in the rings and cups in the ends of the

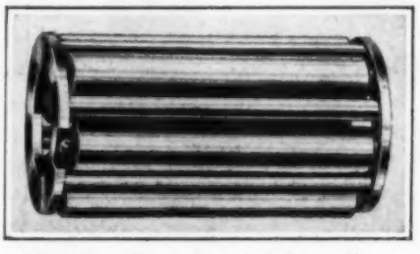


*Fig. 2—Type-L straight roller bearing*

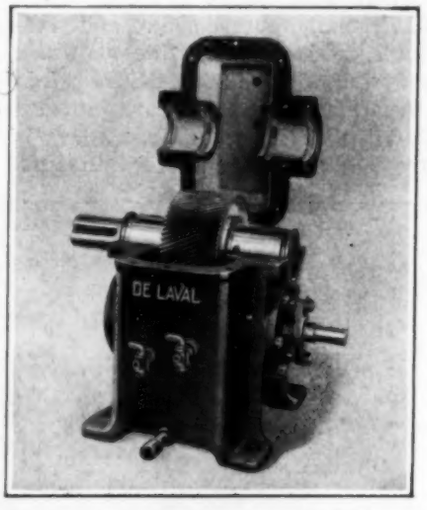
rollers accommodate the end-thrust balls. Some of the types are of compound design with flanges between each series of rollers so that they resemble two or three of the bearings placed end to end. These are intended for use in connection with line shafts, hoists and cranes.

## De Laval Low-Ratio Speed Reducer

The De Laval Steam Turbine Co., Trenton, N. J., has supplemented its line of worm reduction gears with the helical gear speed reducer, illustrated. The gears are of the single-helix type, since the end thrust is small and is taken care of by means of a thrust bearing.

A one-piece casing is used to insure the alignment of the gear and pinion. It serves also as an oil reservoir when the unit is operating at moderate conditions of speed. For higher speeds it is recommended that the gear teeth be sprayed from an oil-circulating system.

The gear shaft is fitted with an oil slinger and oil guards and the pinion is supplied with a split gland than can be removed without disturbing the coupling or any portion of the set-up. The units are usually

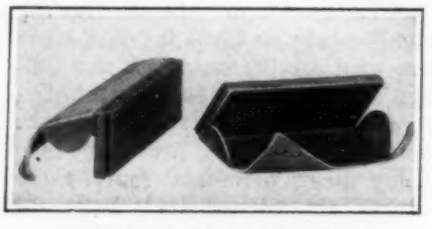



*De Laval Low-Ratio Speed Reducer*

equipped with flexible couplings. The casing is larger and is raised above the foundation, on four feet, to permit free circulation of cooling air beneath the casing as well as around it.

## Pittsburgh Fibre Vise Jaws

Vise jaws, with a removable fibre facing, are being manufactured by the Pittsburgh Instrument & Machine Co., 1026 Reedsdale St. N. S., Pittsburgh, Pa., to be placed over the jaws of the ordinary types of vises. They are for use in protecting soft



*Pittsburgh Fibre Vise Jaws*

or finished work clamped in the vise without affecting the amount of pressure necessary to hold it securely.

The fibre is carried in a steel holder formed from ⅛-in. stock.

# Some Characteristics of the Geneva Movement

**By Bernard M. Fine**

The author discusses an analysis previously published and gives his views, mathematically supported and graphically illustrated

IN HIS article, "Indexing Mechanisms for Automatic Machinery," which appeared on page 15, Vol. 63 of the *American Machinist*, C. S. Seltzer made a kinematic analysis of the Geneva movement, but, owing to the lack of proper approach and objective, he complicated a simple problem and led himself into erroneous conclusions.

To begin with, on page 15, he handles the terms

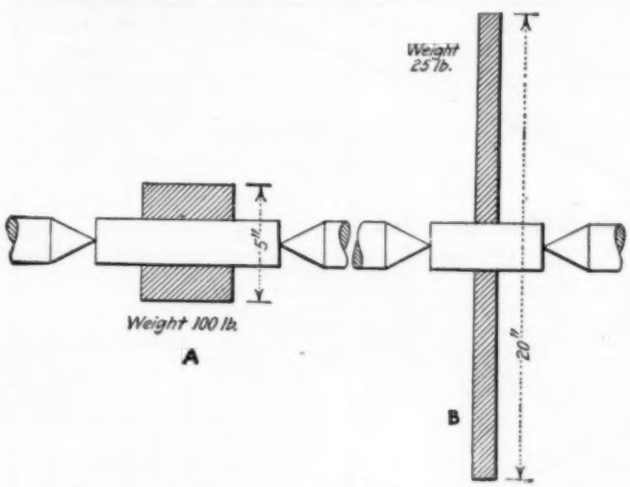



*Fig. 1—To illustrate the variation in torque*

velocity and acceleration loosely, and then obtains an unwarranted equation for them. Mechanics defines velocity as the time rate of change of space, and acceleration as the time rate of change of velocity. In view of this the expression $\frac{V}{V_1} = \frac{ab}{ab_1}$ is not an equation of acceleration. Neither does it represent the velocity, as it is changing at every instant, and at an irregular rate, and is not so simply obtained or expressed, as shown by this equation. If the velocity ratio is equal to the traversed arc ratio then it should be proportional to the relation in Fig. 2. As this latter ratio is only true at the point of maximum velocity, the equation given on page 15 is evidently in error.

By inspection of Fig. 6, page 17, we know that when the arm occupies the 90-deg. position, relative to the slot in the disk, the velocity of the disk is zero. This is equivalent to substituting the value, zero, for angles $X$ and $Y$ in equation 3. Upon doing this I find that the equation does not evaluate to zero, and I am therefore of the opinion that it is wrong.

Giving the velocity of the disk at a certain point as 362 ft. per min. is giving meaningless information, as every point taken radially across the face of the disk has a different velocity. Also Figs. 7 and 8 are not velocity curves, but simply curves of angular relationship.

On page 19, Mr. Seltzer states: "When the mass to be indexed exceeds 500 in.-lb., the outside diameter should be as near as possible to the outside diameter of the work. When the mass to be indexed is less than 500 in.-lb., the outside diameter can suit the number of pockets.

This refers to the diameter of the disk and the following analysis will show that this rule is without rational foundation, and would lead to considerable error in design:

In Fig. 1 at $A$ and $B$ are shown two disks, both of which represent masses of 500 in.-lb., in the sense used by Mr. Seltzer. We know from mechanics that the torque required to change velocity of a rotating body varies directly as the acceleration and mass, moment of inertia, the moment of inertia in the case of a disk varying directly as the mass and square of the radius. Comparing both disks under the same acceleration, we find that the disk shown at $B$ will require 4 times the torque over the one shown at $A$.

The information given in the original article appeared to me to be either in error or lacking practical value and I have made the following analysis of the motion which I believe is in a more useful form.

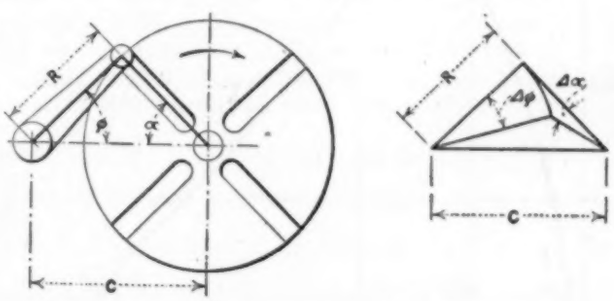



*Fig. 2—Triangular representation of the motion*

Referring to Fig. 2, we find that the Geneva motion can be represented by an oblique triangle, two sides and an included angle of which are known, the angle varying at a known uniform rate. Then we have one side and two angles varying at unknown and irregular rates.

The velocity problem can be stated as follows:

Fig. 2 shows an oblique triangle, side $R$ and $C$ being of constant length. In a given time $\Delta t$, angle $\phi$ moves a small known angular distances $\Delta\phi$. Find the corresponding angular displacement $\Delta\alpha$ in angle $\alpha$ in the same time, $\Delta t$. The solution of this problem will give us the angular velocity of the disk at any instant.

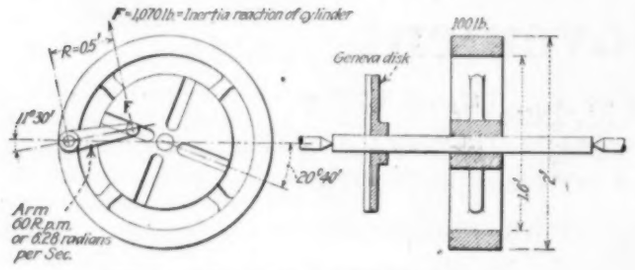



*Fig. 3—Data for an actual example*

From trionometry we know that

$$\text{Tan } \alpha = \frac{R \sin \phi}{C - R \cos \phi} \qquad (1)$$

$$\text{and } \alpha = \tan^{-1}\left(\frac{R \sin \phi}{C - R \cos \phi}\right) \qquad (2)$$

The angle $\theta$ being equal to $\frac{360°}{2N}$, at either engagement or disengagement, $N$ being the number of slots, the known sides $R$ and $C$ can be represented by,

$$\frac{C}{R} = K, \text{ a constant, } = \csc \frac{360°}{2N} = \csc \phi$$

The factor $K$ is the type factor, as it is determined by the number of slots in the disk.

Rearranging (2) as $C = RK$ we have

$$\alpha = \tan^{-1}\left(\frac{\sin \phi}{K - \cos \phi}\right) \qquad (3)$$

With this equation we can find the angular position of the disk $\alpha$ for any angular position of the arm $\phi$.

To find the velocity we need only differentiate (3) in respect to time $(dt)$.

$$\frac{d\alpha}{dt} = \frac{d}{dt}\left[\tan^{-1}\left(\frac{\sin \phi}{K - \cos \phi}\right)\right] = \frac{(K \cos \phi - 1)\,\omega}{(K^2 - 2K \cos \phi + 1)} \qquad (4)$$

Equation (4) gives the instantaneous angular velocity of the disk in radians or degrees per unit of time, for any position $\phi$ of the arm. The angle is expressed either in radians or degrees per unit of time, and $\omega$ is the angular velocity of the arm in either radians or

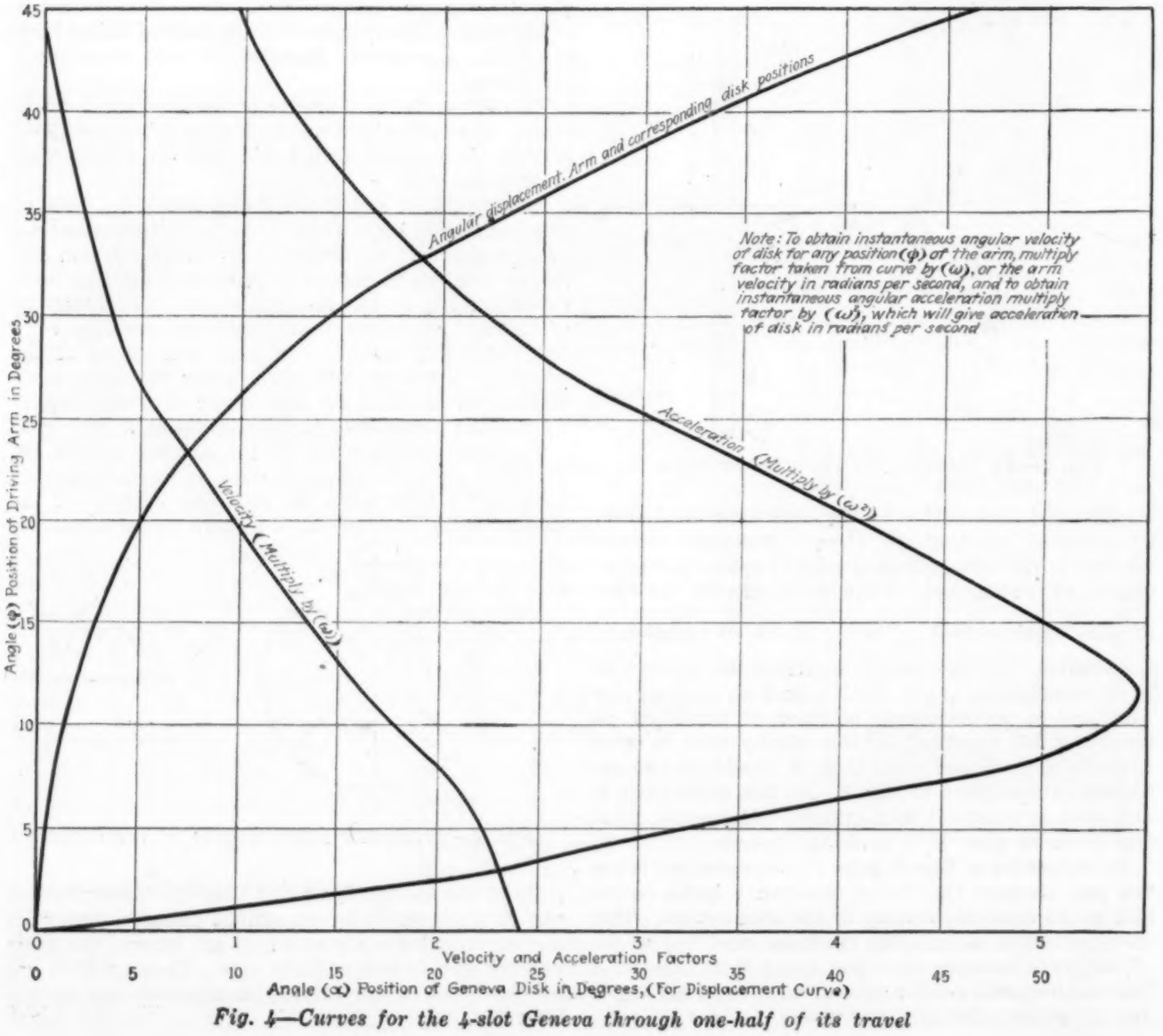



*Fig. 4—Curves for the 4-slot Geneva through one-half of its travel*

degrees per unit of time. Of course, consistent units must be used.

To find the acceleration we must find the second derivative of (3) in respect to time $dt$.

$$A = \frac{d^2\alpha}{dt^2} = \frac{d}{dt}\left[\frac{(K\cos\phi - 1)\omega}{(K^2 - 2K\cos\phi + 1)}\right] = \left[\frac{-K\sin\phi\,(K^2-1)}{(K^2-2K\cos\phi+1)^2}\right]\omega^2 \quad (5)$$

The acceleration can be expressed in either degrees per second per second, or radians per second per second. However, to have a design value it should be expressed in radians per second per second, and the angle $\phi$ and the angular velocity of the arm $\omega$ should be in radians.

### Maximum Acceleration

In designing a motion we will be interested in the point and value of the maximum acceleration. This can be obtained by differentiating (5) with respect to $d\phi$ and equating it to zero, or

$$\frac{dA}{d\phi} = 0, \text{ then } \frac{1+K^2}{2K} = 2\sec\phi - \cos\phi \quad (6)$$

By cut and try methods we can find the position $\phi$ of the arm when the disk is under maximum acceleration. By substituting this value in (5) we can get the maximum acceleration value of the disk, and by substituting in (3) we can find the position of the disk at that time.

The table was obtained from the foregoing formulas and will be helpful in designing a motion.

$$I = \frac{W(r_1^2 + r_2^2)}{2G} = \frac{100\,(1^2 + 0.8^2)}{64.4} = \frac{164}{64.4} = 2.55 \text{ units.}$$

One revolution equals 6.28 radians, and 60 r.p.m. equals one revolution per second or 6.28 radians per second. To find the acceleration $A$ use equation (5) but find the maximum value.

In this case, referring to the table it is 5.37, or $5.37 \times (6.28)^2$ or 209 radians per second per second. Then

$FR = 2.55 \times 209 = 535$ ft.-lb.

If we make the disk 12 in. in diameter we have for our arm

$$R = \frac{D}{2}\tan\theta = \frac{12}{2} \times 1 = 6 \text{ in. or } 0.5 \text{ ft.}$$

Dividing the torque of 535 ft.-lb. by the arm length, we find at the point of maximum acceleration (as shown by the table after an arm rotation of 11.5 deg.), we will need a force of 1,070 lb. to overcome the inertia reaction of the indexed cylinder.

To get the total force required to index, we should add the inertia reaction of the Geneva disk, and the bearing friction to the inertia reaction of the cylinder.

The inertia reaction of the cylinder at entrance and exit of the arm is as follows:

$$FR = IA = 255 \times (6.28)^2 = 101 \text{ ft.-lb.}$$
$$\text{and } F = 202 \text{ lb.}$$

With these figures the designer can properly proportion the various driving elements. It is also well

## Table of Values Derived from Formulas

| Number of Slots in Disk | CSC $\frac{360}{2N}$ | $\frac{K\cos\phi - 1}{(K^2 - 2K\cos\phi + 1)}$ | $\frac{-K\sin\phi\,(K^2-1)}{(K^2-2K\cos\phi+1)^2}$ | Position $\phi$ of Arm at Max. Acceleration Equation 6 | Position $\alpha$ of Disk at Max. Acceleration Equation 3 | $\frac{360}{2N}$ | Acceleration at Entrance and Exit Multiply by $(\omega)^2$ |
|---|---|---|---|---|---|---|---|
| | $K$ | Max. Velocity Multiply by $(\omega)$ | Max. Acceleration Multiply by $(\omega^2)$ | | | | |
| 3 | 1.155 | 6.460 | 28.000 | 6 deg.- 0 min. | 33 deg.- 0 min. | 60 deg.- 0 min. | 1.729 |
| 4 | 1.414 | 2.410 | 5.370 | 11 deg.-30 min. | 24 deg.-40 min. | 45 deg.- 0 min. | 1.000 |
| 5 | 1.701 | 1.429 | 2.290 | 17 deg.-30 min. | 22 deg.- 0 min. | 36 deg.- 0 min. | 0.727 |
| 6 | 2.000 | 1.000 | 1.350 | 23 deg.-10 min. | 20 deg.- 0 min. | 30 deg.- 0 min. | 0.577 |
| 7 | 2.305 | 0.766 | 1.070 | 28 deg.- 0 min. | 18 deg.-18 min. | 25 deg.-43 min. | 0.503 |
| 8 | 2.613 | 0.620 | 0.712 | 32 deg.- 0 min. | 16 deg.-42 min. | 22 deg.-30 min. | 0.420 |

Note—To obtain velocity or acceleration, multiply factor given in table by the angular velocity of the arm in radians per sec. (squared for acceleration). One radian equals 57.3 deg. and one revolution equals 6.28 ($2\pi$) radians.

Using the foregoing formulas, we will proceed to the design of a specific case. While the one shown here may appear to be extreme, it shows the method to employ, and gives one an idea of the inertia force involved in indexing a heavy cylinder.

Fig. 3 shows a hollow cylinder attached to a shaft, which is on frictionless bearings. It is required to index it in quarters, on the basis of the following data, and to find the force required to index the cylinder in order to properly design the Geneva movement:

Revolutions of arm = 60 r.p.m.

Weight of cylinder = 100 lb.

From mechanics we have $T = FR = IA$, where $T$ = torque in foot lb., $F$ the force in lb., $R$ the radius in feet, $I$ the mass, moment of inertia, in ft.-lb. units, and $A$ the angular acceleration in radians per second, per second.

In computing the value $I$ we will not consider the spokes, as they are of small value, taking the rim of the cylinder alone, for which—

to note that the inertia reaction at exit will have bearing on the proportion and type of locking device.

It is interesting to note that if we index the cylinder in eights with the same arm velocity, the maximum inertia reaction of the cylinder is $\frac{0.712 \times 535}{0.537}$ = 71 ft.-lb., and the reaction at entrance and exit is $\frac{0.42 \times 101}{1}$ = 42.42 ft.-lb. As the table shows, the acceleration factors, and consequently the inertia reactions decrease rapidly with the increase in the number of slots in the disk.

Equations 5 and 6, are given in terms of one variable, and are independent of the size of disk and arm, the value $K$, being determined by the number of slots The evaluation of these equations can be done easily and quickly by the slide rule.

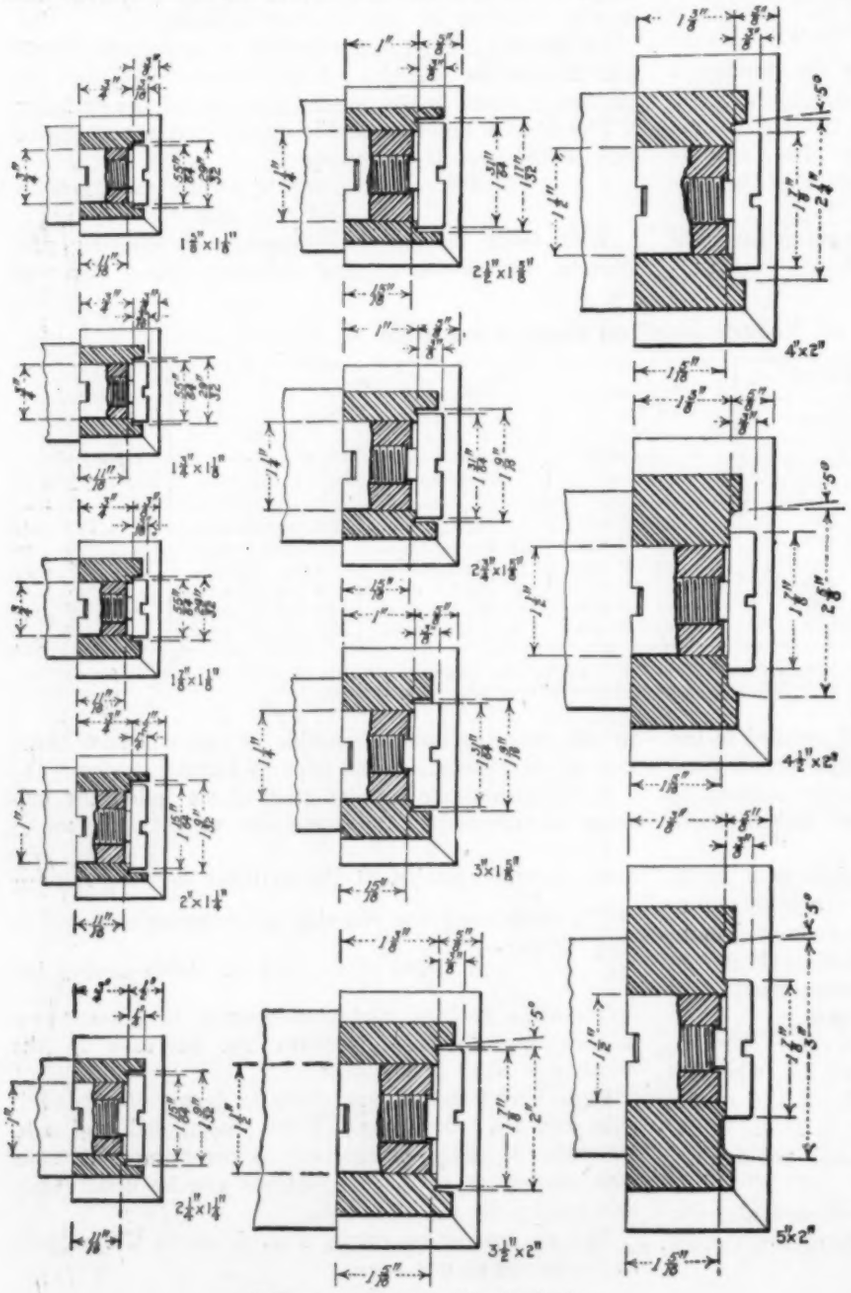
The accompanying curve, Fig. 4, shows the various relationships at one time.

# Standardizing Milling Cutters

By T. R. Jones
Cincinnati Milling Machine Co.

As outlined on page 594, Vol. 62, of the *American Machinist*, at a conference held by the Division of Simplified Practice of the Department of Commerce in Washington, D. C., March 25, 1925, standards for coarse-tooth, plain-hole, shell end-mills were adopted for a period of one year, beginning July 1, 1925. These standards are given in Tables 17 and 19 from the simplified list and are reproduced herewith.

The Cincinnati Milling Machine Co., together with the Union Twist Drill Co., has developed a revised design of the shell end-mills covered in Table 19, the revised designs being shown in the illustration. The revisions in the cutters are only those necessary in order to use an accepted method of holding shell end-mills by means of screws in the ends of the arbors.



*Proposed shell end-mill design*

It is our belief that still further simplification of end-mills can be had by adopting a uniform design. There are at present three types of shell end-mills with plain holes, all being listed as standard in the simplified list of March 7, 1925. We feel that this number can be reduced to two types, one with teeth duplicating the mills covered in Table 16, and the other with coarse teeth to replace the mills of Tables 17 and 19. We suggest making all mills to the dimensions of the last mentioned table.

The advantages are:

1—The arbor made for cutters in Table 19, has a larger diameter than has the arbor for the corresponding diameter of mill in Tables 16 and 17, and is, therefore, more rigid.

2—The overhanging lengths of the arbors and cutters for mills in Table 19, are less than the overhanging length of those of the same diameter in Tables 16 or 17. The shorter overhang provides a stiffer arbor.

3—Cutters made in accordance to the dimensions of Table 19 have less material and require less machining. Particularly where high-speed steel is used. They are cheaper to manufacture than the cutters in Tables 16 or 17, of a corresponding diameter.

4—The ranges of machines on which the cutters will be used, are increased from ⅝ to 1 in. on a standard milling machine and from 1¼ to 2 in. on the duplex-type machine.

**Table XVII—Coarse-Tooth Shell End-Mills**

| Diameter Inches | Length of Cut Inches | Size of Hole Inch | Diameter Inches | Length of Cut Inches | Size of Hole Inch |
|---|---|---|---|---|---|
| 1⅛ | 1⅛ | ½ | 2⅛ | 1⅜ | ¾ |
| 1¼ | 1¼ | ½ | 2¼ | 2¼ | 1 |
| 1⅜ | 1¼ | ⅝ | 2⅜ | 2¼ | 1 |
| 1½ | 1¼ | ⅝ | 2½ | 2¼ | 1 |
| 1⅝ | 1¼ | ¾ | 2⅝ | 2¼ | 1 |
| 1¾ | 1¼ | ¾ | 2¾ | 2¼ | 1 |
| 1⅞ | 1¼ | ¾ | 3 | 2¼ | 1 |
| 2 | 1¼ | .. | .. | .. | .. |

The disadvantages of the dimensions of the cutters in Table 19 are:

1—The hole diameters of the cutters in Table 19 require four arbors to cover the range of cutter sizes, as

**Table XIX—Coarse-Tooth, Shell End-Mills for Cincinnati Milling Machines**

| Diameter Inches | Length of Cut Inches | Size of Hole Inches | Diameter Inches | Length of Cut Inches | Size of Hole Inches |
|---|---|---|---|---|---|
| 1⅛ | 1⅛ | ¾ | 2⅛ | 1⅝ | 1¼ |
| 1¼ | 1⅛ | ¾ | 2¼ | 1⅝ | 1¼ |
| 1⅞ | 1⅛ | ¾ | 3 | 1⅝ | 1¼ |
| 2 | 1¼ | 1 | 3½ | 2 | 1½ |
| 2½ | 1¼ | 1 | 4 | 2 | 1½ |

against three arbors required by the bores in Tables 16 and 17, as listed.

2—The cutters in tables 16 and 17 being longer than those in Table 19, are to that extent more suitable when milling with the side of the teeth.

# News of the Week

## Gear Experts Meet at General Electric Plant

The first annual meeting of the gear distributors and district gear specialists of the General Electric Co. was held at the General Electric Lynn plant, Nov. 4 and 5. Twenty-nine representatives were present. The object of the meeting was to discuss commercial problems relating to fabroil and textolite gears for industrial uses.

Following discussions and talks, a dinner was arranged for the representatives at the Parker House, Boston. The next day a meeting was held with the General Electric salesmen.

Among the delegates were: F. B. Drake, the Johnson Gear Co., Berkeley, Cal.; H. H. Kerr, the Boston Gear Co., Norfolk Downs, Mass.; J. H. Jackson, the Pittsburgh Gear and Machinery Co., Pittsburgh; F. W. Walker, the Philadelphia Gear Works, Philadelphia; Charles F. Goedke, William Ganschow, Chicago; N. H. Byan, the Chicago Rawhide Manufacturing Co., Chicago; John Christensen, the Cincinnati Gear Co., Cincinnati; E. J. Noble, Horsburgh & Scott, Cleveland, and A. C. Hoof, John C. Hoof & Co., Chicago.

## Chamber Advocates Peace-Time Tax Program

Consideration of the conviction of business men that the time has come for working out a permanent peace-time taxation system and of their belief that any taxation plan evolved at the present should aim at this accomplishment is asked of Congress by the Chamber of Commerce of the United States.

In a communication sent to the House Ways and Means Committee, which has in hand the framing of a tax bill, the Chamber submits fourteen proposals covering phases of both tax administration and rate changes. The propositions advanced, the Chamber points out, express the considered viewpoint of more than 1,400 business organizations comprising a membership of 800,000 individuals, firms and corporations representing all phases of commerce and industry the country over. The recommendations, it is declared, have been developed, therefore, by no special business interest, but by a geographical and industrial cross-section of the whole of business.

"Since 1918," says the Chamber's communication, "the war taxes have regularly produced surpluses over the fiscal requirements of the Government. The Government has been able to make two reductions in taxation since that time. Again this year a large surplus is anticipated. It is the belief of the Chamber that the time has come when a permanent peace-time tax program should be worked out and that the tax program of this Congress should give full weight to this consideration.

"Tax reduction, insofar as the anticipated surplus allows, should be immediately effected. There should be a revision of the laws including eliminations and modifications, as well as tax reductions, in order that as nearly as possible we may approach a well considered permanent tax program."

## Will Debate Finishing of Cylinder Bores at Detroit S.A.E.

There seems to be some difference of opinion as to the production feasibility of lapping or stoning automobile cylinder bores. Many concerns have tried the process, found it too expensive and dropped it. Others consider the improved finish worth the extra cost.

Both sides of this question will be discussed thoroughly at a meeting of the Detroit Section, Society of Automotive Engineers, Dec. 17 at the General Motors Bldg., Detroit. A large number of production engineers have agreed to present the experiences of their respective companies and the discussion promises to be a warm one. Members of the factory organizations of the following automobile and parts companies will read brief papers setting forth their experiences both favorable and unfavorable, with the lapping or stoning process: the Hupp Motor Car Co., the Ford Motor Co., the Continental Motors Corporation., the Packard Motor Car Co., the Paige Detroit Motor Car Co., the Wilson Foundry and Machine Co., the White Co., the Chrysler Corporation and Dodge Brothers.

Everybody interested in this phase of automobile manufacture is welcome to the meeting, a nominal charge of fifty cents admission being made for those who are not members of the Detroit section.

### General Electric Awards

Awards totaling $17,651 were paid to 1,728 employees of the General Electric Co. during the six months ending June 30, 1925, for suggestions which increased the efficiency of the company's operations. The suggestions ranged from safety devices for the protection of workers to improved methods of manufacturing; and the individual awards ranged from one to five hundred dollars.

During the corresponding period of 1924, $18,871 was distributed to 1,547 employees of the company; the highest award was $400.

## To Publish Directory of Simplified Practices

Plans for a National Directory of Simplified Commodities are being concluded by W. Chattin Wetherill, director of metals utilization for the Department of Commerce. The directory will contain a list of every commodity that has gone through the simplification mill.

While only fifty simplification agreements have been reached, some 300 others are under consideration, so that the list soon will be longer. There are requests pending which cover more than 1,000 commodities. The work which the Division of Simplified Practice can handle is greatly restricted through lack of personnel. The division simply acts as a clearing house for each group.

Mr. Wetherill is engaged principally in work preliminary to the creation of a National Committee on Metals Utilization. In addition to the preparations for a Directory of Simplified Practice, a study is being made of commodity specifications, with the idea that reductions can be made. The Federal Specifications Board now has listings of over 27,000 specifications for 7,000 articles.

## McGraw-Hill to Publish Electrical Year Book

The McGraw-Hill Co. has purchased the *E M F Electrical Year Book*, published by the Electrical Trade Publishing Co., Monadnock Block, Chicago. The 1926 edition, which will be out on April 1, 1926, will be edited by the staff of the Electrical Trade Publishing Co., and sold by the staffs of both organizations. Headquarters for the year book until completion of the 1926 edition will be at the offices of the Electrical Trade Publishing Co. in Chicago, but information and data may be secured from men of both organizations.

This standard reference book will supplement the service of McGraw-Hill electrical publications by supplying the reference information needed by buyers and specifiers throughout the industry.

Robert Wolfers has joined the McGraw-Hill Co. and will be in charge of directories, lists and a direct-mail department which is being developed to serve McGraw-Hill advertisers. Mr. Wolfers was formerly connected with the Automobile Trade Directory and the Chilton Automobile Directory.

It is planned to extend the directory and list services into other industries now served by McGraw-Hill papers.

J. S. Cortelyou who has for the last year been devoting his time to the Radio Trade Directory will in future direct the compilation of all McGraw-Hill directories and lists.

## Bureau of Standards Increases Scope

Many improvements in the technique of industry, with accompanying benefits to the general public, are set forth in the annual report of the Bureau of Standards submitted to Secretary Hoover by Director George K. Burgess. Improved industrial practice, greater precision in commercial transactions, standard requirements for government purchases, and discoveries in the field of pure science, all mark the record of work accomplished by the Bureau of Standards during the year.

Dr. Burgess reports that during the year the Bureau completed 171,196 tests, an increase of 26 per cent over the preceding year. The character and scope of these tests spanned the province of applied science from sugar to cement, from clinical thermometers and other precision instruments to motor oils and brake-linings, from industrial photography to studies in model housing and home financing.

During the year the Bureau received $43,202.86 for public tests. The total fee value of all tests was $544,384.91, an increase of $34,500 over the corresponding figure for last year. There has been a considerable increase in testing for government establishments, and as a result of the activities of the Federal Specifications Board, this line of activity is likely to increase, the report states.

The accuracy of railroad track scales, tested by the bureau's special car equipment, shows much improvement. During the period covered by the report, 898 commercial track scales and 18 master scales were tested. More than 60 per cent were within the bureau's tolerance requirements.

Large savings in the oil industry are anticipated in consequence of the bureau's work in the standardization of oil-well casing threads. As single casings may be worth from $50,000 to $75,000, and since this work will greatly increase the safety of their threaded joints, large savings are likely to result.

To keep pace with the demands of the electrical industry, the Bureau is extending its facilities to measure potentials as high as 350,000 volts. However, long distance transmission power projects are now planning the use of very high voltages, and so it has become necessary for the bureau to equip itself for tests in the new voltage range.

The bureau's work on internal-combustion engines has advanced to a point where experts state that through suitable engine design economical use can be made of the less volatile fuels which may be more widely used in the future. Other research of interest to motor-car owners deals with the efficiency of brakes and the reaction time of drivers.

Citing some of the unusual problems presented for a solution, the bureau reports that it has designed and constructed a camera for photographing the interior of a rifle barrel, thus permitting a study of the erosion of the barrel without destroying it.

A process of plating steel printing plates with chromium, the hardest metal known, has been developed so that the durability of these plates can be greatly increased.

The development of a standard test for elevator interlocks has greatly improved the quality of these devices and has added to the safety of all those using elevators.

## Conference on Cleaning

Seventy men who take care of the cleaning needs of plants in many industries, will meet in New York, Dec. 7 to 10 for the ninth annual conference on industrial cleaning to be held by the field service men of the Oakley Chemical Co., New York.

Because cleaning operations affect to a great extent, not only cost of production from both quantity and quality standpoints as well, there has been a growing appreciation among manufacturers of the need of men thoroughly trained in this highly specialized subject, who can apply their technical knowledge to the cleaning and related problems of industry today.

Some idea of the extent of the program and variety of subjects covered may be gained by the fact that among the many papers that will be read at the conference, sixteen are on technical subjects covering the petroleum, baking, textile, railroad, automotive, laundry, dairy, power plants, paper, and other industries.

## Co-operate to Further Use of Industrial Trucks

Successful culmination of the first year's activities of the Society for Electrical Development in conducting a program of market development in co-operation with manufacturers of electric industrial trucks and tractors, storage batteries and accessories, has led this group of manufacturers to undertake a program of larger proportion during 1926. At a meeting held in Cleveland on Nov. 10, the progress made during the past year was reviewed, showing that the work has been carried to a point which insures the completion of nearly twice that originally outlined, and additional companies pledged their co-operation and financial participation during the coming year and an augmented advisory committee of manufacturers was elected.

Included in the group of manufacturers co-operating through the Society in furthering a program of business building during the coming year are the following: the Automatic Transportation Co., the Baker R. & L. Co., the Crescent Truck Co., the Eleveyor Electric Industrial Truck Co., the Elwell-Parker Electric Co., the Lakewood Engineering Co., the Yale & Towne Manufacturing Co., the Edison Storage Battery Co., the Electric Storage Battery Co., the Philadelphia Storage Battery Co., the Electric Products Co., the Sangamo Electric Co., the General Electric Co. and the Westinghouse Electric and Manufacturing Co. It is anticipated that additional companies will be added to the group before the first of the year.

## Third Turbo-Generator at Ford Plant

The third huge turbo-generator unit at the River Rouge plant of the Ford Motor Co. has gone into operation, the first having been in service for two years and the second for nearly one year. Eventually there will be eight of these units, designed to produce half a million horsepower.

Ford engineers have determined that the steam turbine is the most efficient source of power to be used where water power is not available. Such a conclusion has been reached after years of research covering oil, gas, and steam engines of all the various designs. The result is that one of the units designed for the Rouge will produce as much power as the entire Highland Park powerhouse.

Similar research has been applied to the boiler house equipment and the preparation of fuels so that steam may be generated in the most efficient manner possible. Eight boilers, with double-ended furnaces have been found to accomplish this satisfactorily, with powdered coal and blast furnace gas as the fuels.

The gas entering near the bottom of the furnace and the powdered coal 25 ft. above are so proportioned in amounts, and the interior of the boiler is so arranged, that they will reach a maximum temperature before striking the boiler tubes. After these gases have passed over the boiler tubes, they circulate through superheaters to the tops of the boilers, the interior height of which is 70 ft. and thence up the eight 333-ft. brick stacks, which furnish a natural draft.

Very little smoke issues from the stacks, for combustion is practically complete, due to the nature of the fuels. Not only is there a maximum production of heat by this process, but the percentage of heat that may be transferred to the water averages as high as 90 per cent. Another economy of such a fueling process is the lack of ashes and slag, there being only one ton of this per furnace a day, as against 100 tons of coal burned.

## "Foremanship"

The experiences of more than one hundred manufacturers who have conducted foreman training in their plants are summarized in a pamphlet, called "Foremanship," just issued by the department of manufacture of the Chamber of Commerce of the United States. The summary deals with foreman training methods used in virtually every branch of industry, and in manufacturing plants of varying production capacities.

In the foreword of the pamphlet the department makes it clear that it does not advocate any particular system or plan, but merely furnishes developed information and experience gathered from reliable sources.

A copy of this pamphlet can be obtained by communicating with the Department of Manufacture, Chamber of Commerce of the United States, Washington, D. C.

# "Financial Politics" Dominate French Trade

## Country on the threshold of industrial crisis—Money problems overshadow difficulties of big and little business—Little or no activity in machinery trade—Imports of raw materials increased over last year

By Our Paris Correspondent

FINANCE, or financial politics, still dominate the French commercial situation. Foreign exchange with the dollar at 25 francs and sterling at 121 francs, for a time added their complications, but the flight was too brief for French manufacturers who were unprepared to secure spot orders abroad in any quantity.

The fall of the first Painleve cabinet and the eclipse of Monsieur Caillaux has only embroiled the situation. What the new ministry, with Monsieur Painleve still its titular head, and this time the holder of the financial portfolio, will accomplish towards putting France more solidly on her feet is still problematic. There is a firm conviction in many quarters that the new cabinet will not last the year out. If the reactive national block comes into power it will be all the worse for foreign traders in France, though for that matter both the factions of the Left and Right are avowed to tariff reform —obviously upward, else it would not be a producer of increased revenue.

### Exploiting the Market

A curious phase of the foreign exchange situation is a disposition to make home prices correspond to the rise of the dollar in the money market. This is understandable for American tools or machinery sold in the French market, for kodaks or canned milk from America, but not for Roquefort cheese or steel automobile wheels made in France. There is no question but that in most lines the situation is being exploited by some traders for all it is worth else the fluctuating prices of home products would not be so obvious.

General trade conditions have notably gone stale beyond belief for the season of the year as a result of the contemporary uproar. Sales have fallen off and prices have risen. Steel mills and fabricators are not guaranteeing price quotations for more than from 24 to 48 hours and on this basis are only booking orders for a bare few weeks ahead.

Wire for export is getting some satisfactory business, due perhaps to low value franc quotations. Prices however have risen within the country. Steel stampings for railway and automobile fittings and parts are more actively in demand than any other similar specialties, but this is seasonable to the extent that if orders did not materialize now they would not appear at all.

A Lyons manufacturing plant has secured business for light railway equipment in the Cape Colony which, considering the relative value of the shilling and the franc, may be said to be due to the matter of exchange in the last analysis.

There is little or no activity in machinery trade except for necessitous demands. Small tools, as well as bolts and rivets, are no longer counted as elements of big business for the moment pending the speeding up which is so anxiously awaited and dependent upon so many things. Only export orders are helping out in these lines. Files are still high in price in spite of keen competition, due to the high wages of employees in this industry, owners say.

A consortium of Belgian, German and English manufacturers of wire netting and similar products is seeking to inveigle French manufacturers into the fold with the idea of dominating world markets.

There is a movement in the small tool trade to once again carry 90 day acceptance accounts with a cash discount of 2 per cent. This is manifestly an effort to get business. It appears more particularly that manufacturers are making the offer rather than that the trade is demanding it. Even putting it the other way around the situation is open to discussion. The dealer will not stock big at this moment on short term bills due. The manufacturer wants shop orders, not stock orders, and to get them he will have to bid in terms of time if not of price.

### Finance All Important

In conformity with most other matters affecting economic and industrial conditions in France all begins and ends with matters of finance. The Bank of France is still advancing the government hitherto unbelievable sums —450,000,000 francs in one week in mid-October; it is also still inflating its bank note issue — an increase of 811,345,060 francs in the same week. This is considered a situation which was not believed possible of conception; easy money, but lacking stability and ignoring a day of reckoning. Big business, or a general revival of prosperity on a scale hitherto unknown, will save the situation; but nothing else but an implicit confidence of the French people in present and future governments and ministries will serve.

General living costs in the Paris district are higher than ever before. Taking the January, 1914, base as 100, the general index for Lyons is 361; Marseilles, 440; Nancy, 376; Bordeaux, 401; Grenoble, 450.

Nine months' automobile exports from France comprised 42,670 units, of which 12,386 went to Great Britain, 2,272 to Germany and apparently none to the United States. Imports for a like period amounted to 13,713 units, of which 12,669 were from the United States, 785 from Italy and 60 from Great Britain.

It is learned that in the first six months of the present year the Union of Soviet Republics placed orders in France to the equivalent value of nearly four million dollars, of which 40 per cent was for tools and machinery. The prospects of Franco-Sovietic trade are considered immense but according to Soviet dogma commerce should be a matter of barter and has accordingly imposed upon France its petrol, its lumber and it manganese mineral for a like amount.

During the past nine months France imported from all countries raw and semi-raw materials for use in the industries to the value of 270,133,000 francs in excess of that imported during the same period of time in 1924. Exports of like materials also increased 1,181,125,000 francs, which leaves a respectable balance in the favor of France. The flimsy money valuation of francs account for much of this glamour for no one will deny that the prosperity of the country is far from being what such figures might indicate. In the meantime France dozes in the supposition that her foreign trade condition is good. Much the same proportionate figures hold good for manufactured imports and exports, which only exaggerates the anomaly.

General imports from the United States have increased a hundred million francs and exports thereto have virtually increased a like figure. The gain for France, however, in a market where even the slightest gain would count at this time is less than nothing. The trade balance between France and the United States is, for the three quarters of a year just passed, the equivalent of 1,798,204,000 francs in favor of the United States.

### Imports Fell Off

Imports of machinery and parts from the United States during eight months of the present year fell off to the value of 71,193,000 francs but those of tools and hardware, following the French customs classification, increased 11,256,000 francs. Like exports from France to the United States increased 8,000,000 francs and 12,000,000 francs respectively. These latter increases have hitherto been wanting during the past three years and even before whereas, on the other hand, the falling off in machinery and parts imports from the United States has replaced the hitherto virtually constant progression.

This question of imports and exports points in a vital way to the apparent quiescent state of affairs in commercial and industrial France. The home market is dwindling and the foreign market is not responding in the quarters where it is needed.

# The Business Barometer

## *This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments*

**By Theodore H. Price**
Editor, *Commerce and Finance, New York*

*(Copyrighted, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)*

THANKSGIVING is a peculiarly American holiday. Before the war someone described it as a festival of hope in a land of hope. But it might now be called a celebration of hope's fruition for in so far as economic conditions are concerned this country now surpasses the wildest dreams of the most optimistic optimists.

In accordance with the traditions of the occasion, many of the newspapers published on Thanksgiviny Day carried long lists of the things we have to be thankful for.

They are impressive and there is no doubt that they have helped to intensify the confidence now so generally felt in our continued prosperity. But it seems unnecessary to elaborate upon them, and it is questionable whether those who emphasize the obvious in business affairs render any great service to the public.

For the one thing now to be feared is that the American people may become the victims of their own enthusiasm and over-discount the development of their inexhaustible resources by borrowing too heavily from the future.

John Law's "Mississippi Bubble," whose bursting almost bankrupted France just two centuries ago was a speculation in the stock of a company that claimed to own most of what is now called the Mississippi Valley. At their highest price, the shares of this company were worth but a microscopically small fraction of what the territory supposed to be owned would be valued at today.

But the grandiose scheme collapsed nevertheless and its history is worth recalling at a time when the prediction that Florida will have a population of 10,000,000 in 1950 is being urged to justify the high prices now asked for unimproved land in some parts of that state.

That the future of the United States will probably surpass the visions of the most visionary is admitted. But it will also be admitted that there is a periodicity in progress and that in the affairs of men as in the sea the ebb is certain to succeed the flood.

Last week there were some indications that the top had been reached in the stock market but the action or inaction of the Federal Reserve Bank of New York in leaving its rate unchanged at 3½ per cent may induce a few of the sold out speculators to buy back their securities. But, upon the whole, any aggressive revival of the bull movement in stocks seems unlikely.

But on the commodity exchanges and in business generally the outlook is different. Almost every commercial staple is now higher than it was ten days ago.

In each case a technical reason is given for the advance, but as previously observed, a tendency so general cannot be without some general significance.

Thus an advance in wheat is explained by reports that the Argentine crop has been injured and cotton is up about 100 points because the government reduced its crop estimate by 88,000 bales. Sugar is higher on reports of continued drouth in Cuba and the insensibility of the New York market to the heavy tenders on December contracts.

Similar conditions prevail in the distributive trade. A big Christmas business is definitely in prospect. Hand-to-mouth buying is much less general, and larger orders for spring delivery are rapidly absorbing the stocks that manufacturers in most lines have been carrying for some time.

A covert threat of a strike in the bituminous coal fields is seen in the recent letter from John L. Lewis, president of the United Mine Workers of America, to President Coolidge. Lewis urged the President to intervene to "maintain the integrity of the Jacksonville agreement," which he charges has been violated by many of the operators. The intention is apparently to make the federal government share the burden of public disapproval of a strike, if one is called. President Coolidge's reply is awaited with interest.

Great Britain is again shipping gold to the United States. A sufficiency, if not a superabundance of bank credit, seems assured and the only cloud on the financial horizon is the one hanging over France, where political chaos threatens and continued inflation seems to be a certain consequence of the government's incertitude.

But to an American elated by the blessings for which he gave thanks last Thursday, the problems that confront the French have but an academic interest. Our problem is to determine when the commercial boom that now seems to impend on this side of the Atlantic will have spent its force.

Of course, it may be strangled at birth by the unexpected or cataclysmal, but barring the unforeseen, it seems likely the tide will rise until the spring and that we shall meanwhile feel the exhilaration of advancing prices and free spending.

But this exhilaration should not make us less vigilant, for spring tides, though generally the highest, are sometimes prevented from rising to the expected level by storms or winds that check their force and have been known to reverse their flow.

## *What's Doing in Industry*

**Early reports indicate that total sales of machine tools in November equaled, but did not exceed, sales in October. This return verified the prediction of many dealers that fall business would be exceptionally good this year. December quotations are already under way, and inquiries that were not acted on before November books closed are expected to count in December sales.**

**The latter part of November saw Detroit again assuming the leadership in total sales volume, automobile manufacturers coming into that market for equipment in large lots. Indianapolis reports business as reassuring, with a new note of encouragement in the receipt of inquiries from foreign sources.**

**Sales in Cincinnati increased materially in the past week, and Buffalo reports the most prosperous business in the year. Up through New England business is forging steadily ahead, sales being estimated at 15 per cent ahead of 1924. Canada reports business better than it has been in several months, with all industries quite busy. Orders in the New York territory are fairly numerous, but inclined to be of small proportions.**

**The trend of general business activity continues upward, with money and commodity markets strong. The only thing to be feared is that people may become the victims of their own enthusiasm and over-discount the development of their resources by borrowing too heavily from the future.**

# The Industrial Review

## *Progress of the machinery and machine-tool business in various parts of the country*

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

### *Buffalo*

The condition of somewhat more than moderate prosperity among machine tool dealers of Buffalo which first began to be apparent about two months ago, is being maintained. Some report that the last half of November will show up better than the first half, and that the month will be better than October.

Most dealers are highly satisfied with business and they unite in predicting a fine business after Jan. 1. Some expect a marked seasonal slump in December, but others believe that it will not materialize noticeably this year.

There are no big orders recorded or in sight but there seems to be a constant stream of small orders. The only weak spot is in the demand for contractors' equipment, but this condition is considered seasonal.

Dealers report collections better at this time than in several months.

There is no railroad activity, locally.

The electrical equipment demand is in line with that of machine tools; nothing big in sight in this line but many small orders and inquiries.

### *New York*

Opinions differ as to the trend of machine tool business in this territory. "Spotty" is probably the best way to describe the situation, which is characterized by plenty of orders, although this demand is mostly for single machines for special purposes.

November sales were below those of October, a fact that is not discouraging, however, because the present volume is quite satisfactory. The great bulk of present orders comes from general manufactures—electric goods, hardware, contractors' equipment and similar lines.

The outlook for December is good. This opinion is based on the number of inquiries now pending which are expected to materialize into orders in the next couple of weeks. Orders that had been expected to come through in November will probably be counted in December.

In the field of small tools and miscellaneous shop equipment, the policy of hand-to-mouth buying continues, and while many manufacturers and jobbers complain of this situation, business is of sufficient volume to assuage their feelings.

Orders placed in the past week included several electric traveling cranes of various capacities, engine lathes, radial drills and planers.

Buyers in this market during the past ten days were: The Elliot Co., the Oakland Motor Car Co., the Cadillac Motor Car Co., The Packard Motor Car Co., the Ford Motor Co., the A. O. Smith Corporation, the Cleveland Punch and Shear Works, the Louisville & Nashville Ry., the Illinois Car and Manufacturing Co., and the Missouri-Pacific R.R.

### *New England*

Opinions of machinery builders in the New England territory is that the present active condition of trade will be maintained well into the middle of 1926. The general situation in all branches of the machinery trade is one of activity requiring overtime operations in many places, and practically everywhere throughout the district working forces are being increased. Estimates indicate that the total volume of business in 1925 will be about 15 per cent over that of 1924.

The automotive trade predominates in the heavy production requirements. Contracts already placed will keep plants busy for two to four months and others to be placed are of large proportion. Plant expansions are being planned.

Production for railroads is of considerable volume and demands of the electric trade are also large. Special machinery business is especially bright.

Export business continues to increase and is now 12 per cent over the total for January of this year.

### *Canada*

Reports from all parts of Canada are to the effect that machine shops are well provided with work. The metal-working industry as a whole is better employed at present than it has been for several months.

The steel industry too is undergoing a change for the better. The most notable manifestation of the better times in prospect for the steel companies is the October report of the production of pig iron and steel. An increase of nearly 200 per cent in the production of steel ingots is recorded, while the increase in the output of basic pig iron showed about 140 per cent over the September total. The year 1925 had been lagging behind its predecessor up to the end of September, but the huge increase in the last month places the current period about 3 per cent ahead of 1924.

Demand in the iron market has been consistently active. In the Montreal district some 4,000 to 5,000 tons of the various grades were purchased during the last couple of weeks. October warehouse sales were better than September totals, which in turn, were an improvement over those of August; so that the trend is definitely upward.

### *Detroit*

With the automobile factories going at full blast in Detroit and other motor centers of Michigan sales of machinery and machine tools are being maintained at a remarkable pace. The continued spurt in the industry is quite unusual for this time of the year. Representatives of machinery manufacturers who have been here for years report that they have never experienced anything like the present upward trend as late in the fall as this.

Figures recently released show that October was by far the greatest month in automobile production which the industry has experienced in its history. The output reached 392,648 as against a previous high mark of 375,787 reached in April, 1925.

Practically all the leading motor plants are buying new equipment and tools. Exceptions to this are noted only with Paige and Rickenbacker. The engineering staff at the Cadillac Motor Car Co. is placing the final orders for machinery to be used in the manufacture of the new "eight" next year. The Hudson Motor Car Co. is buying large quantities of machinery and tools and is more active than for some weeks past. Much of this will be used in the new body plant, while changes in production methods are also leading to purchases. The Ford Motor Co. is replacing considerable equipment as production continues to mount at the Highland Park and River Rouge plants.

The body manufacturers, Fisher, Briggs and Murray, are buying on a more extended scale than for some time. The special demands at present are for tool and die equipment.

Industrial activity in the state is at a high point. The Lindell Forge Co., of Lansing, has moved into its new die-sinking plant, which was only recently completed and equipped with modern machinery. The Federal Drop Forge Co., of Lansing, has completed the foundation for the largest of its proposed hammers which will be installed immediately. The Carrom Co., of Ludington, was a heavy buyer of machinery in the past ten days.

### *Indianapolis*

Steadiness that is rather reassuring continues to feature the local machinery and tool market. Several Indiana manufacturers report an increase in the volume of inquiry from foreign sources and say that actual export shipments, both to Europe and South America, are picking up materially.

Recently a good volume of inquiry has been received from agricultural implement factories. Most of these factories in the Middle-West have been out of the machinery and tool markets for a couple of months, but indications point to a resumption of activity very shortly.

A good machinery demand continues to come from the coal fields in the bituminous districts both of this state and Kentucky. Many replacements are under way and more are contemplated. The automobile factory demand is fair.

Reports show that during the last month manufacturing activities in all lines in this territory have increased. This naturally means an increased demand for machinery.

Sales to furniture manufacturers have not dropped off appreciably, as had been expected. This industry is working at capacity and no curtailment is looked for at present. It is reported that enough orders are on hand to insure work until after the midwinter shows.

Jobbers of used machinery report a little better demand, but the situation is hardly as satisfactory as was expected.

### *Cincinnati*

While a large portion of the orders received in the past week were small, the aggregate bookings were large enough to constitute a material increase in sales, as compared to the previous week, according to statements of Cincinnati machine tool manufacturers. Selling agents report a slight lull the first part of the week, but the demand gradually came back to the normal point.

Manufacturers and selling agents report that orders received during the week were well diversified as to sizes and types of tools, with no tendency toward spottiness or localization. Replacement buying was the feature of the market, but there was some buying for business expansion.

The largest amount of buying was done by concerns in the automotive industries. General machinists and industrial users of machine tools are reported to have done more buying than in the previous week and to have sent in an increased number of inquiries.

While the railroads did not do a great amount of buying during the week, manufacturers regard them as being much more interested than they have been, because they are sending in an increased number of inquiries. Some purchases are reported to have been made by concerns in the steel and electrical industries.

Manufacturers and selling agents express a decided feeling of optimism.

## Niles-Bement-Pond Will Close Jersey Factory

The Plainfield, N. J., plant of the Niles-Bement-Pond Co. is to close down in the spring, according to an announcement made last week. The company will concentrate its business at the original factory, which is at Hamilton, Ohio.

The spread of popular opinion in favor of disarmament is the principal reason for closing the New Jersey plant, officials of the company say. During the war the Niles-Bement-Pond firm developed a large business in the manufacture of tools and machinery which were especially adapted to the processes of munitions production.

Since the armistice this business has disappeared. With the growth of public distaste for war as a method of settling international disputes the company finds no prospect of restoring the extra market for its product.

Officials of the company said yesterday that about 250 people are employed in the plant and offices. Orders at present in hand will keep the place going until spring.

## News of the Automotive Industry

The Department of Commerce announces October production of motor vehicles as 406,569 passenger cars and 45,823 trucks, of which 392,648 passenger cars and 44,129 trucks were made in the United States, and 13,921 passenger cars and 1,694 trucks were produced in Canada. The report is based on figures received from 180 manufactures for recent months, 71 making passenger cars and 126 making trucks (17 making both passenger cars and trucks).

Dodge Bros., Inc., has purchased for cash a majority interest in Graham Brothers, independent motor truck manufacturers. This announcement was made last week by Clarance Dillon, of Dillon, Read & Co., bankers, who acquired control of Dodge Bros. last April. The consideration in the Graham Bros. deal was not disclosed.

Ray A. Graham, secretary of Graham Bros., has been appointed general manager of Dodge Bros. Joseph B. Graham and Robert C. Graham, president and vice-president, respectively, of Graham Bros., will become directors in the Dodge company. Frederick J. Haynes will continue as president of Dodge Bros., and in addition will assume the chairmanship of the executive committee, succeeding Edwin G. Wilmer, who becomes chairman of the board. H. H. Springford will become vice-president, with supervision over financial matters. Graham Bros. will continue to operate as at present, with no change in their executive personnel.

All factory departments of the Olds Motor Works at Lansing closed for a full week for the taking of annual inventory, reopening Dec. 1. The Olds plant has been engaged in heavy production for some months, especially since the new model was brought out. It was recently stated that extensive additions would be made to plant in the way of adding equipment and rearranging floor space so as to permit virtual doubling of production capacity. It is presumed a reasonable heavy production schedule will be resumed after the inventory period, although definite plans have not been disclosed.

The Hudson Motor Car Co. last week turned out car No. 256,000 for 1925. This is twice the number of cars made in 1924 and compares with 88,000 Hudson and Essex cars turned out in 1923 and 60,000 built in 1922. Approximately 98 per cent of the company's output is closed cars and 90 per cent coaches.

Several General Motors executives will sail Dec. 5 to look after certain overseas interests of the corporation in England and on the Continent. The party is composed of C. S. Mott, chairman, John T. Smith, H. L. Barton, M. L. Prentis and W. J. Davidson.

The Reo Motor Car Co. has received an order for 48 bus chassis from Bristol, England, where they will be used in transportation service after being equipped with British-made bodies. The bus units will be shipped within the next 60 days.

The Chevrolet Motor Co. produced 55,504 cars and trucks in October. This was 1,000 more than originally scheduled, and was the third highest production month in the history of the company. During the past seven months Chevrolet's production has averaged 52,457 cars a month. The heavy output maintained the last sixty days aided the company to meet the big demand which has continued consistently throughout the year. A further stabilization of year-round production is expected to follow recent development of inexpensive passenger bus bodies which three body manufacturers are making for the one-ton utility express chassis.

## What the Railroads Are Doing

The October earnings statements of three great trunk lines of the East, made public last week, indicated definitely that the month would set a new high record for railroad earnings, probably surpassing by more than $15,000,000 the largest previous total of net operating income. This was $127,000,000, recorded in October of last year. The statement also indicated that 1925 would be the best year in the history of the carriers from the standpoint of total earnings. Despite these earnings, however, because of the heavy investment in property to render the additional service the rate of return will not be as large as in some years preceding Federal control.

Equipment orders for railroads reported last week included twenty-five steel logging cars for the Bierks Lumber and Coal Co., and fifteen tank cars for the Electro-Bleaching Gas Co., both from the American Car and Foundry Co. The Standard Tank Car Co. booked ten cars for the Rajah Oil and Refining Co. The Reading is in the market for 1,000 gondolas, the New York Central for 500 automobile cars, the Lackawanna for 50 ballast and 25 caboose and the St. Paul for 770 gondolas.

The Atchison, Topeka & Santa Fe Ry. has ordered 500 freight cars each from the Pullman Car and Manufacturing Co. and the American Car and Foundry Co. The balance of 1,850 cars will be placed within the next day or so. The General American Tank Car Co. has received an order for 500 box cars for the Atchison, involving an expenditure of about $1,250,000.

In the construction of mountain locomotives the Swiss locomotive industry is enjoying an international reputation. The Chilian Transandine Ry. has just placed an order for three electric, combined adhesion and cog-wheel locomtives of 1,800 hp. capacity with the Winterthur Locomotive works. The same company has received an order from the Japanese State Rys. for the construction of two electric passenger locomotives and several electric gear wheel locomotives, as well as an order for ten steam locomotives for the Gafsa Railway Co., in Tunis. One of the great Brazilian railway companies has placed an order with the same Swiss works for a special type electric locomotive to be tried on one of its lines.

Transportation experts of the United States and Canada are closely checking the experimental run of a Diesel oil-electric car. It promises a revolution in railway motive power economics. This car has just completed the run from Montreal to Vancouver. It is 60 ft. in length, on two four-wheel trucks, built to carry passengers and baggage. Fifty-six passengers can be accommodated and the car develops sufficient power to carry a trailer even on a 6 per cent grade. On the run, one test showed 334 miles with a cost in fuel consumption of $3.50. Cost of lubrication for that distance averaged one-seventh of a cent per mile. For the same distance a steam train of equal capacity would have consumed fuel costing $66. Oil used is most inexpensive, of the light crude variety. The engine for the small car type weighs 2,576 pounds. It operates an electric generator which provides the actual energy to move the car, and produces 185 hp. at 700 r.p.m., with four cylinders. Across the continent the car averaged a running time of 52 miles per hour, attaining a maximum speed of 60 miles.

## Personals

JOHN V. SNOW has joined the sales force of Wilson-Brown, Inc., New York.

THOMAS R. WILSON, of El Centro, Calif., has been appointed assistant trade commissioner of the Department of Commerce, stationed at Ottawa, Canada.

JOHN L. JOHNSTON, formerly sales engineer for the Westco Pump and Machinery Co., Canada, has joined the sales staff of the Neptune Meter Co., Ltd., Toronto.

W. C. FURNAS has been appointed superintendent of the maintenance department of the Allis-Chalmers Manufacturing Co., of Milwaukee. He succeeds the late C. O. Barrie.

DONALD B. FULLERTON, of 520 West 7th St., Plainfield, N. J., has resigned from the Niles-Bement-Pond Co., where he has been in general charge of the Maag gear department.

W. F. JAMES has been appointed manager of the Philadelphia district of the Westinghouse Electric and Manufacturing Co., succeeding H. H. Seabrook, who has been assigned to special duties.

TINIUS OLSEN, president and founder of the Tinius Olsen Testing Machine Co., of Philadelphia, celebrated his 80th birthday on Dec. 7. He was entertained at a formal reception by many of his friends.

K. D. MCKOLL, of Forest, Ontario, Canada, will represent the United States Electrical Tool Co. as its Canadian district manager with offices in the City of Toronto, Ontario, Canada.

G. H. FRISTOE has become manager of the sales department of the Riverside Machinery Depot, Detroit. Mr. Fristoe was formerly associated with the Stocker, Rumely, Wachs Co., of Chicago.

A. H. SMITH, chief engineer of the Nova Scotia Power Commission, has resigned from office. Harold S. Johnson, hydraulic engineer, has been promoted to fill the vacancy.

H. A. WATKINS has been appointed district sales manager in the New York territory for the Bridgeport Brass Co., of Bridgeport, Conn. He has established offices in the Pershing Square Bldg., 42nd Street.

W. E. BROWN has been appointed district manager of the central station department, New York district, of the General Electric Co., with offices at 120 Broadway, New York, Mr. Brown was formerly manager of the Schenectady local office of the New York district.

JAMES HAWSON, for several years vice-president of the Lake Superior Corporation, of Sault Ste. Marie, Ontario, has accepted an important position with the Sir W. G. Armstrong Whitworth Co., Ltd., London, England.

A. J. TAYLOR, president of the Combustion Engineering Corporation, Ltd., has returned to Toronto, Canada, after a visit to England, Sweden, Holland and Germany. Mr. Taylor took abroad with him four American consulting engineers to study steam accumulators in Sweden and to investigate back pressure turbines.

C. L. WOOD, formerly assistant general manager of sales of the Carnegie Steel Co., has been appointed general manager of sales to succeed William G. Clyde, recently elected president of the company. Samuel R. Hoover has been appointed assistant general manager of sales in charge of the bureau of bars and hoops, to succeed Mr. Wood.

JOSEPH WAINWRIGHT has been appointed general sales manager of the machinery department of Manning, Maxwell & Moore, Inc., of New York. Mr. Wainwright will have complete charge of all the district offices of the company. He has been associated with this firm for eighteen years, serving successively as manager of the Detroit, Boston and Philadelphia offices.

ALBERT P. SLATER has been appointed general superintendent of the foundries of the Detroit Aluminum and Brass Corporation, Detroit. Mr. Slater was formerly with the Aluminum Castings Co., later having charge of the Willys-Overland foundry at Toledo, then in charge of production with the McAdamite Aluminum Co. and the General Aluminum and Brass Manufacturing Co., of Detroit.

GEORGE P. BALDWIN, general merchandising manager of the General Electric Co., was elected a vice-president of the company at a meeting of the executive committee on Nov. 20. In his new position, Mr. Baldwin will have charge of activities connected with the electrification of steam railroads and such other duties as may be assigned. His new headquarters will be at 120 Broadway, New York City. Charles E. Patterson, vice-president in charge of finance since 1920, will take charge of all merchandising activities of the company, including the supervision of company supply-houses. He will make headquarters at Bridgeport, Conn. The accounting department responsibilities of Mr. Patterson will be assumed by the comptroller, S. L. Whitestone.

## Obituaries

F. LEROY PETERSEN, for ten years Western sales representative of the Hendey Machinery Co., of Torrington, Mass., died at his home in Oak Park, Ill., on Nov. 18. Mr. Petersen was well-known in machine tool circles, having been at different times associated with Fairbanks, Morse & Co., and with Manning, Maxwell & Moore, Inc. He was vice-president of the first group of officers on the organization of the Chicago Machinery Club.

ANDREW FLETCHER, president of the American Locomotive Co., died on Nov. 29 at his home in New York. He was 61 years old, and had been ill with heart disease but a short time.

Mr. Fletcher's business interests were wide in scope, his activities extending deeply into iron and steel, in which industry he was a powerful figure. He also was a leader in oil and banking, his directorships in these fields being nearly as many as in the metals industries.

Mr. Fletcher's directorships included the American Locomotive Co., of which he also was president; the American Car and Foundry Co., American Locomotive Sales Corporation, of which he was president; Atlantic, Gulf and West Indies Steamship Lines, Atlantic Gulf Oil Corporation, Chase National Bank of the City of New York, Consolidated Iron Works, of which he was president; First National Bank, Hoboken, N. J; Montreal Locomotive Works, Ltd., of which he also was president; the Superheater Co., W. and W. Fletcher & Co. (North River Iron Works), and William Cramp & Sons Ship and Engine Building Co. Also, as president, the Richmond Locomotive Works, of which he was treasurer; and the North River Derrick Company. He was a member of the American Society of Mechanical Engineers.

## Business Items

The Moore Special Tool Co., of Bridgeport, Conn., has taken over the manufacturing and selling rights for Williard spring toolholders.

The Mal-Gray Castings Co. has been incorporated at Cambridge City, Ind., with a capital stock of $100,000 to manufacture and sell malleable castings.

The Stoer Machinery Co., of Philadelphia, has been appointed sales agent in that territory for the R. K. LeBlond Machine Tool Co., and for the Smith & Mills Co., both of Cincinnati.

The Howser Valve Tool Manufacturing Co. has been incorporated at Laporte, Ind., to deal in tools and machinery. The incorporators are Walter M. Howser, Ernest W. Hunt, Andrew Doll and Eugene Grambo.

The United States Electrical Tool Co. of Cincinnati, is arranging to travel its own salesmen in the Southern States, and has withdrawn its selling arrangements with the Backmeier Sales Corporation, of Cincinnati, Ohio.

The J. H. Williams Co. of Niagara Falls, Ontario, manufacturer of small tools, has been taken over by the McKinnon Industries, Ltd. Extensions are planned to the newly acquired factor of the McKinnon company.

The Allis-Chalmers Manufacturing Co. of Milwaukee, has opened a branch sales office at Houston, Texas, in charge of R. I. Moore, who was previously located in the Dallas office. Temporary quarters are at 231 Rodgers Building but after the first of the year the office will be located permanently at 1108 Post Dispatch Building.

N. A. Strand & Co., of Chicago, announce the appointment of the Machinists Supply Co., of Pittsburgh, as distributor for their line of shafting and equipment in western Pennsylvania and the northwestern part of West Virginia. At the same time announcement is made of the appointment of Beals, McCarthy & Rogers, Inc., of Buffalo, N. Y., as distributor in western New York.

The Allis-Chalmers Manufacturing Co., of Milwaukee, has opened a district office in Lima, Peru, in charge of W. G. Bolton. This office, as well as the one at Oruro, Bolivia, are a branch of the company's office at Santiago, Chile, of which W. R. Judson is manager. The Oruro office is in charge of P. G. Gilliard, succeeding Mr. Erling Winsnes, who has returned to the United States.

The American Brown Boveri Electric Corporation, announced last week the acquisition of the Moloney Electric Corporation, of St. Louis, one of the largest electrical transformer manufacturers in the country. The corporation's officials also announced the election to the board of William V. Griffin of the Anthony N. Brady Estate, and Fred Allison, an engineer of the Ford Motor Co.

It has been announced that with a view to creating an organization of broad scope, in both general sales and engineering service in steam, hydraulic and industrial plant equipment, the interests of the Taylor Stoker Co., Ltd., of Canada, and the Cleaton Co. (Canada), Ltd., both of which concerns have been doing business in Canada for several years, have now been merged with Affiliated Engineering Companies, Ltd.

## Trade Catalogs

**Milling Machines.** The Kempsmith Manufacturing Co., Milwaukee, Wis., has issued its Catalog No. 50 to cover the general line of Kempsmith products, including milling machines, tools, jigs and fixtures. The book is bound in flexible leather and has two hundred and forty-four 4 x 6½-in. pages.

The first section contains sample production estimate sheets and methods of production. The greater part of the book is devoted to short descriptions and to photographs of milling machine jobs of many varieties. The accessories and attachments for the machines are illustrated and described. Jigs, fixtures and other products of the company are included.

There are nearly 100 pages of tables which will be found useful. This section includes not only tables convenient for milling machine operators, but to engineers as well. Gearing and gear cutting tables, horsepower and grinding tables and information, tables of analysis and heat-treatment of many specifications of steels, and tables of mensuration have been prepared.

## Catalogs Wanted

RUBESSI DE FARIA, of Rua Triyuti, 83, Santos, Brazil, would like to receive catalogs from American manufacturers of wood-working and metal-working machinery, electric supplies and machinery, telephone and telegraph apparatus and spare parts, agricultural and textile machinery, sugar and oil machinery, locomotives, motors and mining machinery.

## Calendar of Local Meetings

### National Association of Cost Accountants

**New York Chapter.** Dec. 8. "Case Problem in Standard Cost Variations," by N. M. Cartmell.

**Albany Chapter.** Dec. 9. "Laying Out the Cost Accounting Plan."

**Worcester Chapter.** Dec. 10. "The Treatment of Slow Moving Products in Inventory."

**Los Angeles Chapter.** Dec. 15. "Cost of Producing and Transmission of Power," (with pictures.)

**Cleveland Chapter.** Dec. 16. "Budgetry Control and the Principles of Burden Distribution."

**Rochester Chapter.** Dec. 16. The methods employed in Rochester industries in the collection and distribution of manufacturing burden. Speakers, I. W. Briggs and Z. L. Augustine.

**Buffalo Chapter.** Dec. 17. "Handling Production Costs from Raw Material to Finished Product."

**Boston Chapter.** Dec. 17. "Administrative and Selling Costs," by Charles F. Rittenhouse.

**Scranton Chapter.** Dec. 22. "Inventory Control," by LeRoy Chappell.

**San Francisco Chapter.** Dec. 28. "Preparing to Start the New Year Right—What Should Be Done?"

### Society of Automotive Engineers

**Indianapolis.** Dec. 10. Indiana Section meeting. Subject: "High Duty Engines."

**Buffalo.** Dec. 15. "Transportation Service," by Ernest Murphy.

**Cleveland.** Dec. 14.

**Dayton.** Dec. 16. "The Organization and Operation of the General Motors Proving Ground," by O. T. Kreusser.

**Detroit.** Dec. 17. Methods of Cylinder Lapping.

**Chicago.** Dec. 18. "Present Day High Efficiency Motors," by Fred S. Duesenberg.

**Northern California.** Dec. 29. "Problems of Fleet Operation," by Harold Jarvis.

**New York.** Jan. 14. Annual dinner, Hotel Astor.

**Detroit.** Jan. 26 to 29. Annual meeting.

### American Society for Steel Treating

**Buffalo.** Jan. 21 and 22. Winter sectional meeting, Hotel Statler.

**Hartford.** June. Spring sectional meeting.

## Forthcoming Meetings

**American Society of Mechanical Engineers.** Annual meeting, Engineering Societies Bldg., 29 West 39th St., New York City, Nov. 30, to Dec. 4. Calvin Rice, secretary, Engineering Societies Bldg., New York.

**National Exposition of Power and Mechanical Engineering.** Fourth annual event, Grand Central Palace, New York City, Nov. 30 to Dec. 5. Charles F. Roth, manager, International Exposition Co., Grand Central Palace, New York City.

**American Association for the Advancement of Science.** Annual meeting, Kansas City, Mo., Dec. 28, 1925, to Jan. 2, 1926. Barton E. Livingston, secretary, Smithsonian Institute Bldg., Washington, D. C.

**American Society for Steel Treating.** Winter sectional meeting, Hotel Statler, Buffalo, N. Y., Jan. 21 and 22. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

**Society of Automotive Engineers.** Annual meeting, General Motors Bldg., Detroit, Jan. 26 to 29. Coker F. Clarkson, secretary and general manager, 29 West 39th St., New York City.

# The Weekly Price Guide

## *Rise and Fall of the Market*

**Iron and Steel.**—Pig-iron prices, at the present time, show little tendency toward further rise; buying is slight for first-quarter delivery. Coke is down $2 per ton from level of Nov. 20. Steel demand grows heavier from week to week, with firmer tendencies as to price. Steel sheet buying is particularly active compared with four months ago. Semi-finished and hoop steel, bars, and tin plates are moving in good volume. Prices of the principal hot-rolled products remain about the same as a week ago.

**Non-Ferrous Materials.**—Lead is ¼c. and zinc, ¼c. per lb. above the Nov. 20 level at New York warehouses. Copper dropped ¼c. and tin, ¼c. per lb. in the meantime. Linseed oil declined 0.4c. and white and red lead, ¼c. per lb. at New York, during week.

(All prices as of Nov. 27)

## IRON AND STEEL

**PIG IRON**—Per gross ton, f.o.b.:

| | |
|---|---|
| CINCINNATI | |
| No. 2 Southern | $24.05 |
| Northern Basic | 24.27 |
| Southern Ohio No. 2 | 24.27 |
| NEW YORK—Tidewater Delivery | |
| Southern No. 2 (silicon 2.25@2.75) | 28.37 |
| BIRMINGHAM | |
| No. 2 Foundry | 22.00@23.00 |
| PHILADELPHIA | |
| Eastern Pa., No. 2x (silicon 2.25@2.75) | 24.16 |
| Virginia No. 2 | 29.17 |
| Basic | 23.16 |
| CHICAGO | |
| No. 2 Foundry local | 23.00 |
| No. 2 Foundry, Southern (silicon 2.25@2.75) | 26.55 |
| PITTSBURGH, including freight charge ($1.76) from Valley | |
| No. 2 Foundry | 22.27 |
| Basic | 22.27 |
| Bessemer | 22.27 |

**IRON MACHINERY CASTINGS**—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

| | |
|---|---|
| Detroit | 5.00@5.50 |
| Cleveland | 5.00@5.25 |
| Cincinnati | 5.00@5.50 |
| New York | 5.25@5.50 |
| Chicago | 5.25@5.75 |

**SHEETS**—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

| Blue Annealed | Pittsburgh Mill Base | New York | Cleveland | Chicago |
|---|---|---|---|---|
| No. 10 | 2.30@2.40 | 3.89 | 3.15 | 3.50 |
| No. 12 | 2.35@2.45 | 3.94 | 3.20 | 3.55 |
| No. 14 | 2.40@2.50 | 3.99 | 3.25 | 3.60 |
| No. 16 | 2.50@2.60 | 4.09 | 3.35 | 3.70 |
| Black | | | | |
| Nos. 18 to 20 | 2.95@3.05 | 4.15 | 3.75 | 3.90 |
| Nos. 22 to 24 | 3.00@3.10 | 4.20 | 3.80 | 3.95 |
| Nos. 26 and 27 | 3.05@3.15 | 4.25 | 3.85 | 4.00 |
| No. 28 | 3.15@3.25 | 4.35 | 3.95 | 4.10 |
| Galvanized | | | | |
| No. 10 | 3.40@3.50 | 4.35 | 4.25 | 4.25 |
| Nos. 12 to 14 | 3.50@3.60 | 4.45 | 4.35 | 4.35 |
| No. 16 | 3.65@3.75 | 4.60 | 4.50 | 4.50 |
| Nos. 18 to 20 | 3.80@3.90 | 4.75 | 4.65 | 4.65 |
| Nos. 22 to 24 | 3.95@4.05 | 4.90 | 4.70 | 4.80 |
| Nos. 26 and 27 | 4.10@4.20 | 5.05 | 4.95 | 4.95 |
| No. 28 | 4.40@4.50 | 5.35 | 5.10 | 5.25 |

**WELDED STEEL PIPE**—Warehouse discounts are as follows:

| | New York | | Cleveland | | Chicago | |
|---|---|---|---|---|---|---|
| | Black | Galv. | Black | Galv. | Black | Galv. |
| 1 to 3 in. steel butt welded | 53% | 39% | 55½% | 43½% | 54% | 41% |
| 3½ to 6 in. steel lap welded | 48% | 35% | 53½% | 40½% | 51% | 38% |

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

| Size, Inches | List Price per Foot | Diameters Inches External | Diameters Inches Internal | Thickness Inches |
|---|---|---|---|---|
| 1 | $0.17 | 1.315 | 1.049 | .133 |
| 1¼ | .23 | 1.66 | 1.38 | .14 |
| 1½ | .27½ | 1.9 | 1.61 | .145 |
| 2 | .37 | 2.375 | 2.067 | .154 |
| 2½ | .58½ | 2.875 | 2.469 | .203 |
| 3 | .76½ | 3.5 | 3.068 | .216 |
| 3½ | .92 | 4.0 | 3.548 | .226 |
| 4 | 1.09 | 4.5 | 4.026 | .237 |
| 4½ | 1.27 | 5.0 | 4.506 | .247 |
| 5 | 1.48 | 5.563 | 5.047 | .258 |
| 6 | 1.92 | 6.625 | 6.065 | .28 |

**SEAMLESS STEEL TUBING**—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ½-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

| O.D. Inches | List Price per ft. | Differential Discount | O.D. Inches | List Price per ft. | Differential Discount |
|---|---|---|---|---|---|
| ½ | $0.15 | 50% | ⅞ | $0.18 | 35% |
| ⅝ | .16 | 45% | 1 | .19 | 31% |
| ¾ | .17 | 40% | | | |

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.30 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

**MISCELLANEOUS**—Warehouse prices in cents per pound in 100-lb. lots:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Spring steel (light) (base)* | 7.00 | .... | 4.65† |
| Spring steel (heavier) | 4.00 | .... | 4.00 |
| Coppered Bessemer rods (base) | 6.05 | .... | 6.20 |
| Hoop steel | 4.49 | .... | 4.15 |
| Cold rolled strip steel | 6.35 | .... | 6.80 |
| Floor plates | 5.55 | 5.60 | 5.50 |
| Cold drawn shafting or screw | 4.15 | 3.90 | 3.60 |
| Cold drawn flats, squares | 4.65 | 4.40 | 4.10 |
| Structural shapes (base) | 3.34 | 3.20 | 3.10 |
| Soft steel bars (base) | 3.24 | 3.10 | 3.00 |
| Soft steel bar shapes (base) | 3.24 | 3.11 | 3.10 |
| Soft steel bands (base) | 3.99 | 3.20 | 3.65 |
| Tank plates (base) | 3.34 | 3.40 | 3.10 |
| Bar iron (3.00 at mill) | 3.24 | 3.21 | 3.00 |
| Drill rod (from list) | 50@60% | 55% | 60% |

Electric welding wire, New York. ⅛", 8.25c.; ¼, 7.85c.; ⅛" to ¼, 7.35c. per lb. *Flat, 1/16@½-in. thick. †F.o.b. cars.

## METALS

Current Prices in Cents Per Pound

| | | | |
|---|---|---|---|
| Copper, electrolytic (up to carlots), New York | | | 14.87½ |
| Tin, 5-ton lots, New York | | | 64.00 |
| Lead (up to carlots) E. St. Louis | 9.60 | New York | 10.87½ |
| Zinc (up to carlots) E. St. Louis | 8.85 | New York | 9.87½ |

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Antimony (Chinese), ton spot | 21.00 | 20.50 | 20.00 |
| Copper sheets, base | 23.25 | 23.25 | 23.00 |
| Copper wire, base | 20.37½ | 17.12½ | 17@17½ |
| Copper bars, base | 22.37½ | 21.75 | 22@22½ |
| Copper tubing, base | 25.25 | 25.25 | 25.00 |
| Brass sheets, base | 19.62½ | 19.62½ | 19.37½ |
| Brass tubing, base | 24.25 | 24.25 | ..... |
| Brass rods, base | 17.37½ | 17.37½ | 17.12½ |
| Brass wire, base | 20.12½ | 20.12½ | 20.50 |

# Shop Materials and Supplies

## METALS—Continued

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Aluminium ingots, 98 to 99%, 1 to 15 ton lots | 28@29 | 28.00 | 28.03 |
| Zinc sheets (casks) | 12.00 | 12.60@12.95 | 12 27 |
| Solder (½ and ½), (case lots) | 40.00 | 41.00 | 38@42 |
| Babbitt metal, delivered, New York, cents per lb.: | | | |
| Genuine, highest grade | | | 80.87½ |
| Commercial genuine, intermediate grade | | | 56.00 |
| Anti-friction metal, general service | | | 31.50 |
| No. 4 babbitt (f.o.b.) | | | 15.50 |
| Nickel, f.o.b. refinery, cents per lb.: | | | |
| Ingots 31.00 Electrolytic 38.00 Shot | | | 32.00 |

**SPECIAL NICKEL AND ALLOYS**—Price in cents per lb., f.o.b. Huntington, W. Va.:

| | |
|---|---|
| Hot rolled nickel sheet (base) | 52.00 |
| Cold rolled nickel sheet (base) | 60.00 |
| Hot rolled rods, Grade "A" (base) | 50.00 |
| Cold drawn rods, Grade "A" (base) | 58.00 |
| Manganese nickel hot rolled rods "E"—low manganese (base) | 54.00 |
| Manganese nickel hot rolled rods "D"—high manganese (base) | 57.00 |

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

| | | | |
|---|---|---|---|
| Shot | 32.00 | Hot rolled rods (base) | 40.00 |
| Blocks | 32.00 | Cold drawn rods (base) | 48.00 |
| Ingots | 38.00 | Hot rolled sheets (base) | 42.00 |
| Cold rolled sheets (base) | | | 50.00 |

**OLD METALS**—Dealers' purchasing prices in cents per pound:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Crucible heavy copper | 12.25@12.50 | 12.00 | 11.75@12.25 |
| Copper, heavy, and wire | 11.75@12.00 | 11.37½ | 11.25@11.75 |
| Copper, light, and bottoms | 10.00@10.50 | 9.75 | 10.25@10.75 |
| Heavy lead | 8.37½@8.87½ | 8.00 | 8.50@8.75 |
| Tea lead | 6.00@7.00 | 7.50 | 7.50@7.75 |
| Brass, heavy, yellow | 7.50@7.75 | 7.50 | 7.25@7.75 |
| Brass, heavy, red | 10.00@10.25 | 9.75 | 9.25@9.50 |
| Brass, light | 6.25@6.62½ | .... | 7.25@7.75 |
| No. 1 yellow rod turnings | 8.25@8.75 | 8.25 | 7.50@7.75 |
| Zinc | 5.25@5.75 | 4.75 | 5.00@5.50 |

**TIN PLATES**—American Charcoal—Bright—Per box

| | | New York | Cleveland | Chicago |
|---|---|---|---|---|
| "AAA" Grade: | | | | |
| IC, | 14x20 | $11.25 | $11.45 | $11.50 |
| "A" Grade: | | | | |
| IC, | 14x20 | 8.85 | 9.40 | 9.50 |
| | Coke Plates—Primes. | | | |
| 100-lb., | 14x20 | 6.45 | 6.10 | 7.00 |
| | Terne Plates—Small lots, 8-lb. Coating | | | |
| IC, | 14x20 | 7.75 | 6.95 | 7.50 |

## MISCELLANEOUS

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Cotton waste, white, per lb. | $0.15@0.22 | $0.19 | $0.20 |
| Cotton waste, colored, per lb. | .10@.15½ | .18 | .17 |
| Wiping cloths, washed white, per lb | .17½ | 36.00 per M | .15½ |
| Sal soda, per 100 lb. keg | 2.25 | 2.25 | 2.75* |
| Roll sulphur, per 100 lb. keg | 3.75 | 3.75 | 4.50 |
| Linseed oil, per gal., 5 bbl. lots | .99 | 1.13 | .99 |
| Lard cutting oil, 25% lard, per gal. | .55 | .50 | .54 |
| Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal. | .35 | .35 | .26 |
| Belting—Present discounts from list in fair quantities (½ doz. rolls). | | | |
| Leather—List price, 24c. per lin. ft. per inch of width for single ply. | | | |
| Medium grade | 40% | 40% | 30–10% |
| Heavy grade | 30–10% | 35% | 30–5% |
| Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft. | | | |
| First grade | 50% | 50–10% | 50% |
| Second grade | 50–10% | 60–5% | 50–10% |

*In 175 lb. kegs.

## *Comparative Warehouse Prices*

| New York | Unit | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|---|
| Soft steel bars | per lb. | $0.0324 | $0.0324 | $0.0324 |
| Cold drawn shafting | per lb. | .0415 | .0415 | .0405 |
| Brass rods | per lb | .1737½ | .1687½ | .1612½ |
| Solder (½ and ½) | per lb. | .40 | .395 | .40@.41 |
| Cotton waste | per lb. | .15@.22 | .15@.22 | 14@21 |
| Washers, cast iron (½ in.) | per 100 lb. | 7.00 | 7.00 | 6.50 |
| Emery, disks, cloth, No. 1, 6 in. dia. | per 100 | 3.55 | 3.55 | 3.38 |
| Lard cutting oil | per gal. | .55 | .55 | .55 |
| Machine oil | per gal. | .35 | .35 | .29 |
| Belting, leather, medium | off list | 40% | 40% | 40–2½% |
| Machine bolts up to 1x30 in. | off list | 40% | 40% | 45% |

## MISCELLANEOUS—Continued

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets: | | | |
| Flint paper | $5.46 | $5.84 | $5.65 |
| Emery paper | 10.71 | 11.00 | 10.71 |
| Emery cloth | 29.48 | 31.12 | 29.48 |
| Emery disks, 6 in. dia., No. 1 grade, per 100: | | | |
| Paper | 1.49 | 1.41 | 1.49 |
| Cloth | 3.55 | 2.67 | 3.20 |
| Fire clay, per 100 lb. bag | | .60 | .75 |
| Coke, prompt furnace, Connellsville | per net ton | | 4.50@5.00 |
| Coke, prompt foundry, Connellsville | per net ton | | 5.00@6.00 |
| White lead, dry or in oil | 100 lb. kegs | | New York, 15.25 |
| Red lead, dry | 100 lb. kegs | | New York, 15.25 |
| Red lead, in oil | 100 lb. kegs | | New York, 16.75 |

## SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ½-in. and larger.
Case hardened ½x½-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ½-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in., $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{1}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ½-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ½-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

# Machine Requirements and Industrial Construction

## Machine Tools and Equipment Wanted

**Mich., Detroit**—Superior Piston Ring Co., 6425 Epworth Blvd. — miscellaneous shop equipment for finishing piston rings.

**Mich., Detroit**—Wilson Paper Products Co., 3410 Grand River Ave.—punch press, 3 in. stroke, wide opening (used).

**Mo., Cape Girardeau** — Electric Supply Co.—armature and stator coil spreader, capable of forming coils up to 24 hp. (used).

**Mo., Kansas City**—Koch Butchers Supply, 519 Wyandotte St.—machinery and equipment for the manufacture of refrigerators, a 2 story, 117 x 300 ft. building at 14th and Kirkwood St., has been leased for the plant.

**N. Y., Auburn**—Henry & Allen—200 lb. Bradley cushioned helve hammer, belt driven.

**N. Y., Buffalo**—H. S. Campbell, 89 Tioga St.—lathe and small tools for proposed auto repair station.

**N. Y., Buffalo**—Pratt & Lambert, Inc., 1451 West Ave.—equipment for proposed 2 story, 50 x 50 ft. steel castings factory. Estimated cost $30,000.

**N. Y., Buffalo**—Trico Products Corp., 624 Ellicott St.—equipment for proposed 1 and 2 story, 30 x 135 ft. addition to metal products factory. Cost to exceed $25,000.

**O., Columbus**—Connors Hoe & Tool Co., c/o T. F. Connors, 39 East Northwood Ave. complete line of machinery for the manufacture of hoes, forks and rakes for proposed factory building.

**O., Delaware** — M. C. Blackford, Spring and Franklin Sts. — shearing machine (used).

**Pa., Midland**—Board of Education—machines for trade and vocational School under construction.

**Pa., Philadelphia**—Pennsylvania R.R. Co., Broad St. Station, S. Porcher, Gen. Purch. Agt.—2 milling machines.

**Pa., Phoenixville**—Phoenix Iron Works—one 10 ton, one 30 ton overhead electric cranes and one soaking pit crane.

**Pa., Pittsburgh**—Carnegie Steel Co., Carnegie Bldg., C. A. Miller, Purch. Agt.—15 and 25 ton, overhead and 10 ton wall cranes.

**Pa., Pittsburgh**—National Tube Co., Frick Bldg.—milling machines.

**Pa., Pittsburgh**—R. D. Nuttall Co., Harrison Ave.—grinder, molding machine, lathe.

**Wis., Milwaukee**—The A. F. Meckelburg Sash & Door Co., 760 31st St., new machinery, tools and equipment for proposed addition to factory and mill. Estimated cost $100,000 to $125,000.

**Ont., Norwich** — Norwich Electric Fixtures—equipment for foundry for the manufacture of brass and aluminum castings. Estimated cost $10,000.

**Ont., Orillia**—The Canada Wood Specialty Co., Ltd., W. D. Mott, Secy. and Treas.—dowel machine, etc., for proposed sawmill, etc.

**Ont., Parkhill**—J. C. Knapton—complete equipment for repair shops to replace fire loss. Estimated cost $50,000.

**Ont., Sturgeon Falls** — Sturgeon Falls Planing Mills, I. E. S. Martin, Purch. Agt. (sash, doors, mouldings, etc.)—doweller, jointer and other machinery.

**Que., Audet**—J. A. Fecteau—sawmill machinery and equipment.

**Que., Baillargeon** — A. Gorselin — additional equipment for proposed extension to sawmill.

**Que., Belle Riviere**—H. Urbain (planing mill, etc.)—saw sharpener and sander.

**Que., Bic**—D. Plourde (sash and door manufacturers)—machinery.

**Que., Charlesburg**—A. Renaud—machinery for planing mill.

**Que., Tottenham**—W. H. Tipping—jointer and other machinery.

## Opportunities for Future Business

**Calif., Los Angeles**—Bd. of Education, will soon receive bids for the construction of a junior high school, including mechanical shops, etc. Estimated cost $200,000. Kistner & Co., Detwiler Bldg., Archts. Noted Aug. 6.

**Calif., Los Angeles**—Bd. of Education, will soon award contract for the construction of science and shop buildings for Fremont High School on San Pedro St. Estimated cost $175,000.

**Calif., Los Angeles**—Hernendez & Cupit, c/o Vickers-Dingwell Co., Hillstreet Bldg., Archts., are having plans prepared for the construction of a 2 story, 160 x 160 ft. garage and stores building at Van Ness and Washington Sts. Estimated cost $160,000.

**Calif., San Francisco**—Herman Safe Co., 216 Fremont St., safe and vault builders, is having plans prepared for the construction of a 1 and 2 story factory at Main and Howard Sts. Estimated cost $75,000. T. Ronneberg, Crooker Bldg., Engr.

**Calif., San Francisco** — J. Pasqualetti, Humboldt Bank Bldg., is having plans prepared for the construction of a 3 to 6 story garage on Stockton St. Estimated cost $150,000. Private plans.

**Calif., San Francisco**—E. Tropp, E. Murphy & Bell Bros., 129 Sutter St., are having plans prepared for the construction of a 10 story garage on O'Farrell St. Estimated cost $800,000. E. H. Denke, 1317 Hyde St., Archt.

**Colo., Denver**—The Colorado Fuel & Iron Co., is having plans prepared for the construction of a cast-iron pipe foundry addition to its iron and steel mills to increase capacity from 35 to 200 tons daily.

**Fla., Miami**—The Frick Co., Waynesboro, Pa., manufacturers of ice making machinery and equipment, plans the construction of a branch plant here.

**Ga., Atlanta**—W. T. Candler, Candler Bldg., awarded contract for the construction of a 3 story garage. Estimated cost $300,000.

**Ind., Indianapolis**—I. M. Holmes, 218 American Central Life Bldg., will soon receive bids for the construction of a 4 story, 60 x 195 ft. garage and stores building at Market and Alabama Sts. Estimated cost $150,000. R. N. Edwards, Union Trust Bldg., Archt. and Engr.

**Ind., Indianapolis**—Standard Oil Co., 802 Lord St., awarded contract for the construction of a 1 story, 82 x 86 ft. garage and a 3 story, 54 x 160 ft. warehouse at South Keystone St. and Big Four R.R. Estimated cost $40,000 and $50,000 respectively.

**Mass., Worcester**—J. F. McGuiness, Foster St., plans the construction of a 3 story, 62 x 92 ft. repair shop. Estimated cost $60,000. Architect not selected.

**Mich., Bay City**—The Kuhlman Electric Co., 26th and Jefferson Sts., awarded contract for the construction of a 75 x 250 ft. addition to factory for the building of larger sizes of transformers.

**Mich., Detroit**—Cadillac Motor Car Co., Scotten Ave., plans the construction of a 1 story, 125 x 750 ft. assembly building. A. Kahn, 1000 Marquette Bldg., Archt.

**Mich., Menominee**—Prescott Co., Broadway and Wabash Ave., awarded contract for the construction of a 1 story, 92 x 140 ft. addition to machine shop. Noted Nov. 12.

**Mich., River Rouge**—Ford Motor Co., B. R. Brown, Construction Dept., Highland Park, is having plans prepared for the construction of a 1 story addition to motors building here. Estimated cost $200,000. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

**Minn., St. Paul**—L. W. Jordan Co., 4th St. and College Ave., is having plans prepared for the construction of a 2 story, 140 x 170 ft. garage and sales building at Main and 4th Sts. Estimated cost $150,000. C. H. Johnston, 715 Capital Bank Bldg., Archt.

**Minn., St. Paul**—Mack International Motor Truck Corp., T. F. Egan, Branch Mgr., 2234 University Ave., plans the construction of a 3 or 4 story assembling plant at University and Cromwell Aves. Estimated cost $400,000. Private plans.

**Mo., Kansas City**—Congress Garage Co., c/o R. Gornell, 3619 Broadway, Archt., awarded contract for the construction of a 5 and 6 story garage. Estimated cost $500,000.

**Mo., St. Louis** — Liberty Foundry Co., 7600 Vulcan St., awarded contract for the construction of a 1 story, 90 x 160 ft. and 2 story, 30 x 90 ft. iron foundry at 5000 South 38th St. Estimated cost $45,000.

**O., Cleveland**—The Sterling & Welch Co., A. C. Hook, Secy., 1225 Euclid Ave., awarded contract for the construction of a 2 story, 72 x 172 ft. warehouse and garage on Chester Ave. Estimated cost $400,000.

**O., Cleveland** — H. N. White, 5225 Superior Ave., awarded contract for the construction of a 3 story, 32 x 106 ft. addition to factory for the manufacture of musical instruments. Estimated cost $40,000.

**O., Columbus**—Stanton Motors Co., A. T. Stanton, Pres., 841 North High St., plans the construction of a 2 story, 162 x 175 ft. garage and salesroom at Second Ave. and High St. Estimated cost $125,000. Architect not selected.

**O., Dayton**—Schenk & Williams, Mutual Home Bldg., Archts., will soon receive bids for the construction of a 4 story, 70 x 200 ft. factory for Duro Pump & Mfg. Co., Monument Ave. Estimated cost $175,000.

**O., Elmwood Place** (Cincinnati P. O.)—Worthing Pump & Machine Co. awarded contract for the construction of a 1 story, 114 x 140 ft. addition to factory. Estimated cost $60,000.

**Okla., Oklahoma City**—Buick Motor Co., 504 North Broadway, is having preliminary plans prepared for the construction of a 100 x 150 ft. garage at 10th St. and Broadway. Estimated cost $200,000. Architect not selected.

**Pa., Philadelphia** — Hood Bros., Palethorpe and Oxford Sts., awarded contract for the construction of a 15 story, 16 x 20 ft. and 24 x 96 ft. addition to shop for the manufacture of hardware at 4336 Orchard St.

**Pa., Pittsburgh**—Richard Irvin & Co., Ferguson Bldg., Archts., is receiving bids for the construction of a 4 story, 90 x 172 ft. garage on 4th Ave. for Pittsburgh Parking Co., c/o architect. Estimated cost $150,000.

**R. I., Providence**—Rhode Island Fittings Co., Hills Grove, awarded contract for the construction of a 1 story, 50 x 163 and 50 x 50 ft. factory for the manufacture of flanges, fittings, etc., at Georgia and Allens Aves. here. Estimated cost $60,000.

**Wis., Milwaukee** — G. W. Boller, 370 Brady St., awarded contract for the construction of a 120 x 143 ft. garage, sales and repair building at 284-288 Farwell Ave.

**Que., Richmond**—Skelly Electrical Mfg. Co., D. A. Skelly, Pres., plans the construction of a 2 story, 100 x 300 ft. building for the manufacture of electrical appliances. Estimated cost $150,000.